Nova School of Business and Economics

Universidade Nova de Lisboa

Thesis presented as part of the requirements for the Degree of
Doctor of Philosophy in Finance

Basel III new capital requirements, impacts and bank behavior

Gonçalo Leónidas Ferreira da Rocha, 656

A Thesis carried out on the PhD of Finance
under the supervision of Professor Miguel Ferreira

13 JULY 2015

ABSTRACT

In this thesis I research the new capital adequacy regulation coming out of Basel III. In the first paper I claim there is a significant change in the type of shareholders in response to a regulatory capital shock and the new shareholders might not be the "desired" ones. Then I investigate how banks comply with the emerging regulation of Basel III to conclude that banks target higher ratios than required, pointing to the conclusion that regulation may not be binding of the optimal capital structure. Most of the adjustment to higher ratios is done through retained earnings. Size (or even higher requirements of the SIFI group) does not explain bank behavior towards higher capital ratios. Finally, in the third paper, I investigate the speed of adjustment and the quality of capital to fill the gap between current capital ratios and bank internal capital targets. If regulators ask for speed, they get quality capital from banks; however, if they ask for capital, banks do not deliver speed.

JEL Classification: G280

Keywords: Bank, Regulation, Capital Adequacy, Basel III

ACKNOLEGDEMENTS

I wish to thank the helpful contributions of Prof. Miguel Ferreira as supervisor, and also Profs. Paulo Pinho, Pedro Pita Barros, André Castro Silva, Guido Maretto, Igor Cunha, Melissa Prado, Martijn Boons and all Research Group seminar participants at NOVA School of Business and Economics, where these papers were presented.

All the econometric tests were performed with R. Please refer to R Development Core Team (2012). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org/.

CONTENTS

The impact of capital regulatory shock on bank ownership

Gonçalo Leónidas Rocha

PhD student at NOVA School of Business and Economics

goncalo.l.rocha@novasbe.pt

January 2014

ABSTRACT

For some years, researchers could not find a clear effect of capital adequacy on the risk profile of banks, as shareholders could increase the riskiness of the assets (qualitative effect), crowding-out the effect of reduced leverage (volume effect). Some shareholders might have the will to increase the riskiness of the assets, but they may lack the power to do so. Considering only "powerful" shareholders, definitive conclusions were drawn but with constant ownership profile. In this paper I investigate whether there is a significant change in the type of shareholders in response to regulatory capital shocks and, if so, will the banking system be in the hands of more "desired" shareholders. I find that ownership profile responds to a regulatory shock, changing the risk appetite of the ruling power at the bank. I find more banks and the government in the ownership of undercapitalised banks and much less institutional shareholders and free float. I claim that these new shareholders may not the desired ones, given the objective of the regulatory change, as they are associated with a preference for more leverage. One possible explanation for this crowding-out effect is that regulators are trying to contain idiosyncratic risk (more linked to the riskiness of the assets) with a rule that contains systematic risk (capital adequacy). This has a distorting effect on ownership. Another insight can be drawn from the tests: supervisors should be aware of significant ownership movements that cause the crowding-out.

JEL Classification: G280

Keywords: Bank, Regulation, Capital Adequacy, Ownership

1 Introduction

Since the financial crisis of 2008, the finance world witnessed several changes in bank regulation, most of them directed at preventing another similar crisis as the recent one, not adequately prevented. I will address the impact of Basel III new capital adequacy rules, trying to get some insight on the impact on risk profile and ownership changes.

The climax of the crisis hit precisely when banks were starting fulfilling capital requirements of Basel II. Notwithstanding the fact that Basel II was not tested[1], authorities rushed to change the regulation into a more stricter definition of capital adequacy. In Basel III, Core Tier I capital became central to the discussion, and no longer Tier I + Tier II. In this first moment, regulation called for more capital, without any material change on the risk weights for the assets (in an IRB setting, this is a supervision issue). This movement is global. However, Basel III allows for the incorporation of local adjustments on top of minimum requirements.

This change means that banks have to increase equity through seasoned offers, or make a strong effort to reduce core capital consumption. By reducing leverage, this move should reduce systematic risk as a first order effect.

According to Basel III, banks will face a revision of Tier I to Core Tier I (also referred as Common Equity). The threshold level changes are: from 2% to 3,5% in Jan 2013, 4% in Jan 2014, 4,5% in Jan 2015[2]. Announcement was made in December 2010, but somehow anticipated (the guideline proposals were presented in December 2009 after a study of their impact done by survey on more than 250 banks in July 2009).

[1] Implementation of Basel II started in 2007. However, capital reduction was restricted by a provision in place in the first two years of Internal Ratings Based (IRB) approach. As such, no bank had achieved a significant capital saving before the crisis, even those few that started to implement IRB models.

[2] There are additional buffers, with delayed implementation.

In this paper, I study the impact of recent changes in bank capital regulation on ownership structures. The questions I try to answer are: Was there a significant change in the type of shareholders in response to the recent capital regulatory shock? In case of ownership change, is the banking system in the hands of more "desired" shareholders?

If a capital regulatory change commands an ownership structure reshuffling, it is possible the objective of the regulation to be enhanced or crowed-out by the new owners. These movements should be incorporated on regulation design or in supervision tactics.

This theme was already explored previously, mainly by Laeven & Levine (2009). The new approach here is the study of the response to a change, instead of a more static experiment developed by those authors.

I will explore the ownership of banks using two different approaches. In the first one, I use the voting rights of each type of shareholder. This reveals the "will" that each shareholder type places for the risk profile of the bank they own. However, that might not lead to a risk change, as the investor type may lack the "power" to change profile. In the second approach, I will use the controlling shareholder type, the one with the power to influence the risk profile of the bank.

Controlling shareholders should influence the risk profile of the bank to maximise their utility function. However, when there is a regulatory change, the easiest way to adapt the risk profile (changing asset composition, leverage, and so on) may not be available, and so I expect to see some changes in the preferred ownership. This is a crucial point: an effective regulatory shock (to reduce bank risk) should contain the increase ownership from "undesired" shareholders. If not contained, probably they will increase the risk profile of the bank to protect the franchise.

This is a good moment to study the impact of regulatory shocks: as most changes in regulation are responses to the recent financial crisis, it can be safely said that shocks were not anticipated before 2008, which is very convenient for this experiment. Theory suggests that highly capitalised bank should choose to operate at low levels of risk, due to the capital at stake (effect ex-post). However, when banks have to call for more capital, they have to promise more risk to shareholders (effect ex-ante). Since 2009-2011 is a period of massive calling of funds, it is possible to set the best experimental environment to test this ex-ante effect.

I expect financially unconstrained and diversified shareholders (mutual and pension funds, for instance) to reduce their stake in undercapitalised banks. I claim that bank returns are so poor after the crisis that even an unconstrained shareholder would increase capital only as a last option to keep the going concern.

I also expect free float to step back of undercapitalised banks, as the capital call will force this investor type outside of its preferred habitat.

I would expect banks to reduce significantly their stakes in other banks, mainly if they are constrained by Basel rules. However, as part of the resolution process of several banks, related banks were called to take over, most of the time with no capital increase in the failed bank (the liquidity run on the acquired bank was stopped by the credibility added on the acquisition). And so the shock studied here might lead to an increase in the banking share of ownership in other banks. This is exactly the opposite effect desired by Basel regulators[3].

Finally, I expect Government to step in at undercapitalised banks if risk strategy is

[3]Furthermore, bank concentration has negative side effects as it enhances the ”too big to fail” effect and reduces competition.

commanded by financially constrained or undiversified block-holders. Government intervention is almost always done with some sort of capital strengthening. This reduces the leverage of the banks but the full impact on society may be questionable[4].

I will examine ownership structure in two dimensions: identity / type of owner and the level of ownership concentration.

At this point, I must clarify the concept of ownership desirability. A "desired" owner, from the regulatory perspective, is an investor with no will or power to increase the risk profile of the bank he owns. From a society point of view, there are some more utility dimensions and externalities to be considered[5]. In this paper, I am only concerned with the risk profile of the bank, and so I expect diversified shareholders to increase the risk profile of the bank and undiversified shareholders to command the opposite effect.

A major issue of existing literature is identification. Shareholders can invest on banks that reveal the risk profile of their choice, or they can impose a risk profile on the bank they own. As a first approach, I will consider that small shareholders will always choose the bank with the desired risk profile, and they will sell if a regulatory shock moves the risk profile away from their preferred habitat. For large shareholders, the choice of the bank in the first place might be self-selected, but after a shock, I expected them to influence the risk profile instead of selling. I expect small shareholders to react mainly quantitatively (the number of shares owned) and large shareholders to react

[4]Government ownership is probably undesired on bank development grounds, as it seems to have a negative impact on credit to the private sector as a percentage of GDP (see Barth *et al.* (2000).). Even in terms of bank safety, the expected effect may not be positive, as a paper from Iannotta *et al.* (2007) presents evidence of higher insolvency risk for Government owned banks.

[5]After the global financial crisis, two dangers were frequntly referred: Too Big To Fail (TBTF) and Too Big To Save (TBTS). TBTF banks force Governments to take control or to provide liquidity during stress events, exposing taxpayers to large losses. This concern is specifically referred in the introduction of Basel III ruling (see Basel (2010)). TBTS refers to very large and interconnected banks that cannot be saved by their local governments. Bank stakes in other banks are further penalised in the new regulation: stakes (above 10%) in banks are deducted from Common Equity Tier I instead of the previous split of 50%/50% between Tier I and Tier II. Stakes below 10% were also subject to a more stringent treatment under Basel III.

mainly qualitatively (on the risk profile).

Another identification problem is endogeneity: if a given shareholder intends to force some risk enhancement on a bank, he may wish to buy stakes in other firms (banks or not) to increase diversification. As such, the acquisition of stakes in later banks is not directed by the will to increase risk. Considering that my database (to be presented later) does not reveal any investor with a significant portfolio of controlling stakes in several banks, I classify this concern as insignificant in this experiment.

Since the regulatory movement is global, for all banks, a control population is hard to get. So, I will use for this purpose banks where the change is hardly limiting (they were already largely complying).

I found that ownership profile responded to the recent capital regulatory shock, changing the risk appetite of the ruling power at the bank. I find more banks and the government in the ownership of undercapitalised banks and much less institutional shareholders and free float. I claim that these new shareholders may not be the desired ones, given the objective of the regulatory change.

Consistent with the results, there are some lessons to be learned by regulators. First of all, some banks with ownership structures favouring risk increase should be more closely monitored. Also, changes in ownership structure should be monitored and be viewed as alert signs for supervision.

2 Review of the Literature

There is a large body of literature relating bank regulation, risk profile and ownership structures of banks. However, as far as I know, there is no paper studying the dynamic impact[6] of regulatory changes in risk profile of banks and ownership structure. Several studies address the link between ownership and bank financial performance[7], sometimes with links to some form of financial market regulation[8]. However, performance is connected to risk through equity value volatility, whereas regulators are more concerned with overall risk of the bank, most of the time studied using measures of asset value volatility, Z-scores or ZP-scores[9]. Regulation impacts equity risk[10] as a side effect, and so deals with the channel that impacts on shareholders preferences, affecting ownership structure.

Koehn & Santomero (1980) found that the increase in capital adequacy requirements have mixed effects of asset risk, but the dispersion of the probability of failure increases. Their paper point to two main conclusions. First of all, regulators could not achieve an unambiguous increase in bank safety demanding higher levels of capital as there was an asset reshuffling in response to the capital adequacy rule change. Secondly, effective regulation should add restrictions on asset composition alongside capital. The puzzle on the mixed impact might have been solve by Laeven & Levine

[6] In fact, I am really doing "comparative statics", as I cannot truly follow ownership in a dynamic setting.

[7] See for instance Micco *et al.* (2007), Caprio Jr. *et al.* (2007) and Iannotta *et al.* (2007).

[8] La Porta *et al.* (1999) addresses the issue of Government ownership and the protection of property rights.

[9] For Z-score, or the probability of bank failure, see Boyd & Graham (1986) and Barry *et al.* (2011). The ZP score is an average Z-score weighted by the level of assets of each bank in a group (market, some specific characteristics), and can be used to see the probability of failure between markets or between banks with different characteristics (like the type of the major shareholder). See Goyeau & Tarazi (1992) and again Barry *et al.* (2011).

[10] Barth *et al.* (1997) use a link between regulation (only restricted activities regulation) and equity risk to address bank performance. However, no connection is made to ownership. Hassan *et al.* (2005) use equity volatility to find that low levels of management ownership of the stock increases the risk of the bank. When ownership is higher than 25%, the significance erodes. The link to regulatory issues is made through differences in risk profile (that the authors do not support) between commercial banks and savings & loans, or between state-chartered and national-chartered banks.

(2009) when they added a new dimension to the impact: differences in bank ownership. These authors present a static approach between regulation, risk and ownership. They found that the link between bank regulation, namely capital adequacy and the stringency of its application, and the risk profile of the bank is significantly influenced by the ownership structure of the bank. They found that capital requirements promote safety with any type of ownership structure. However, this is done through an increase in the capital/asset ratio, as the volatility of ROA is not affected[11]. The channel is the valuation, which is a surprising conclusion. Safety comes from reduced competition, or the return of the "3-6-3" rule! The new level of capital increases the set-up cost, reducing the number of players or, at least, changing market shares in favour of a more concentrated industry. This is hardly the aim of the regulator. For the authors, capital stringency[12] has two effects: the direct effect promotes safety; the indirect effect through interdependency with shareholding increases risk. Summing up, stringency increases risk above a certain ownership threshold.

A more dynamic approach was used by Barry *et al.* (2011). Using ownership data for European commercial banks, the authors analyse the link between ownership structure and risk in both privately owned and publicly held (listed in a stock exchange) banks[13]. They consider five categories of shareholders: managers, individuals/families, institutional investors, non-financial firms and banks. The authors find that ownership explains risk differences mainly for privately owned banks (the market monitoring makes it harder for a shareholder to influence the risk profile of the bank). A higher equity stake of either individuals/families or banks decreases asset risk and default risk. In

[11]This is an interesting point for regulation: capital adequacy is a regulatory response to a problem: risky assets. As the authors show, the remedy is not addressing the origins of the problem, just increasing the tolerance to a bad outcome.

[12]Stringency here is the tightness of capital adequacy application. For instance, an 8% rule on assets plus off-balance items is more difficult to overcome than an 8% on risk-weighted assets computed with internal methods.

[13]A similar paper from Iannotta *et al.* (2007) find higher risk on Government and privately owned banks when comparing to mutual banks. However, they removed significant changes in ownership from the database, and have no link to regulatory environment.

addition, institutional investors and non-financial companies impose riskier strategies when holding higher stakes. For publicly held banks, changes in ownership do not affect risk taking. Market forces seem to align the risk-taking behaviour of publicly held banks, such that ownership structure is no longer a determinant in explaining risk differences. However, higher stakes of banking institutions in publicly held banks are associated with lower credit and default risk (need to rescue if things go wrong). The paper gives a strong support for understanding links between ownership and risk[14]; however, the impact of regulation is not addressed.

Barth *et al.* (2000) present an empirical study linking regulation environment in US and Europe and the impact of bank efficiency and fragility. Although not directly addressed, there is somehow an "event study" on the impact of changing regulation. In this paper, ownership structure is not addressed. In a similar way, Demirgüç-Kunt *et al.* (2004) examine the impact of bank regulation on interest margins and operating costs (finding it is not significant after controlling for country specific characteristics).

Saunders *et al.* (1990) present a paper relating regulation, risk and ownership (managerially controlled or shareholder controlled banks). The approach to risk distinguishes systematic and diversifiable risk, since these two types of risk have very different impacts on shareholder types. Some dynamics of regulation is granted to the analysis by considering structural shifts in regressions to address major regulatory stances of the seventies and eighties. The idea of the study is more in line with ours but considers very broad concepts of regulation, ownership and risk. One interesting aspect of this paper, that deals only with management ownership, is that managers, when they have a relatively large stake on the bank, but not enough to represent a big portions of their wealth, behave like diversified shareholders. However, only the idiosyncratic risk increases, not the systematic risk. The channel is asset reshuffle and not increased

[14]Faccio *et al.* (2011) present a similar evidence for non banking firms. They found that large diversified shareholders tend to command riskier projects in the firm.

leverage.

Beltratti & Stulz (2009) published some evidence on the impact of several bank characteristics on stock market performance following Lehman bankruptcy. Some regulation variables are used, but bank characteristics are not dynamic. There is almost no studied relationship between changes in regulation and bank characteristics. There is only a mild reference (it is not empirically supported, only a possible explanation) that strong supervision authorities led to worse performance, maybe because they demanded more capital for each dollar of write-downs, something that was also not studied. However, main conclusions seem to point that shareholder-friendly boards lead to worse performance (probably due to a riskier profile during a bad state of the world). On the other hand, banks with more capital[15], more deposits-to-assets and loans-to-assets performed better. These characteristics are the target of most bank regulation nowadays.

Tsai *et al.* (2009) analyse the link between dominant ownership (foreign or domestic, private or Government) and poor diversification. The paper founds that domestic private ownership limits bad diversification but not good one. Government limits any type of diversification, with positive impact in bad times, but restricting performance in good times. This paper has some link between ownership, risk and different moments in time. However, ownership rotation is not considered, nor behaviour is the response to a regulatory shock.

The present analysis stands out as the first to dynamically address the impact of changing capital regulation on risk profiles and ownership structures. This is of major importance for regulators, giving insights over the outcome of the planned moves within Basel III.

[15]This effect is more evident through equity than tier 1. This is an issue of capital quality, or the concept of capital stringency presented by Laeven & Levine (2009).

3 Data and Summary Statistics

I used a sample of the largest banks in the world by total assets[16]. The use of total assets as the ranking variable instead of market value is needed to include listed and non-listed banks. The database covers 234 "independent"[17] banks, each of them with more than 40 bn USD of assets by 2006. As much as possible, I will try to avoid the " survival bias " by using the list of top banks in December 2006; however, some data is missing in subsequent years and may determined the exclusion of the exiting bank from some tests[18].

Ownership data is mainly collected from Factset (including institutional and insider ownership), a data service from Thompson Reuters. The information is complemented with BankScope Fitch IBCA, the annual reports of the banks and some Form 10-K filings to the Securities and Exchange Commission. I have also relied on Factset to consolidate ownership by investor group. Changes in ownership were considered on an annual basis. This option avoids noise and makes comparable different data sources, namely annual reports.

For the major shareholder group to be considered a controlling one, a minimum threshold for the voting rights was defined. Lins *et al.* (2011) use 25% for such threshold whereas Laeven & Levine (2009) use a 10% limit for the voting rights, directly or indirectly owned. Caprio Jr. *et al.* (2007) use 5%. Considering that the database includes the largest banking groups in the world, I opted for the smaller value. A bank

[16] See the list of all banks considered in Appendix 1.

[17] The concept of independency here means they are not controlled by another bank in the database, and so I avoid double counting.

[18] As an example, Lehman Brothers and Merrill Lynch are not included in the database from 2008 onward. The first no longer exists as a bank and the second is no longer "independent" in the concept used here, as it is fully owned by Bank of America, also included in the database

is considered controlled by a shareholder if he is the largest one with more than 5% of the voting rights. If no investor has more than 5%, the bank is considered widely held. I will not consider in these stakes shares owned by the bank itself or its subsidiaries (as treasury stock usually does not vote or receive dividends), but I will consider other autonomous vehicles as their own mutual and pension funds.

I have considered 15 types of shareholders: brokers, banks, employees, financial conglomerates, foundations, free float, families, government, non-financial firms, insurance companies, mutual & pension funds, private banks, private equity, sovereign funds[19] and trusts & nominees. Not all types are sufficiently represented as controlling shareholder of the list of banks, but they are sufficiently different from one another not to recommend a broader aggregation.

The dataset has an yearly average of 87 trillion USD in bank assets and the ownership is divided among investor types as follows:

[19] A Government has an incentive to reduce the risk of the bank, as it faces unlimited liability as a lender of last resort or in terms of deposit insurance. Furthermore, it is the natural candidate to rescue a bank in a bailout. However, a foreign Government does not face that liability. It can force higher risk on a diversified portfolio, or it can use a more arms-length approach and let the vehicle to decide. The approach used here is to make a group of its own.

Table 1

This table reports the share of each investor type on the ownership of all banks. Sample consists of the largest 234 banks in the world, all with total assets in 2006 above USD 40 bn.

Investor % of common equity	2006	2007	2008	2009	2010	2011
Broker	1,1%	1,8%	1,1%	0,8%	1,0%	1,1%
Bank	9,1%	10,6%	12,5%	10,2%	9,1%	9,0%
Employee	0,5%	0,6%	0,5%	0,5%	0,5%	0,4%
Financial Conglomerate	1,4%	1,3%	1,3%	1,4%	1,3%	1,4%
Foundation	2,5%	2,7%	2,8%	2,9%	2,3%	1,8%
Free Float	39,6%	35,1%	32,8%	31,0%	30,9%	31,0%
Family	1,4%	1,7%	1,4%	1,2%	1,1%	1,1%
Government	12,4%	11,4%	15,8%	19,3%	19,1%	19,5%
Non-Financial Firm	1,9%	1,8%	2,1%	2,5%	2,8%	3,0%
Insurance Company	2,6%	2,5%	1,7%	1,6%	1,5%	1,4%
Mutual & Pension Fund	24,0%	26,2%	23,1%	23,3%	23,9%	23,8%
Private Banking	0,5%	0,5%	0,4%	0,4%	0,4%	0,4%
Private Equity	0,4%	0,3%	0,4%	0,5%	0,5%	0,4%
Sovereign Funds	0,7%	0,9%	1,5%	1,7%	2,3%	2,4%
Trust & Nominees	2,0%	2,3%	2,5%	2,7%	3,2%	3,4%

As it can be seen, 84% of assets are on the hands of just four investor types. The most striking effect is the increase in government share and a mirror decrease in free float after the crisis. The unfolding of a systemic bank crisis last for three years on average[20], and so I would expect the government ownership to decrease only after the end of our period of data (however, it can last for several years, as seen on the Japanese crisis of the nineties).

Tests are concentrated on just the four main investor types, as those are the ones with sufficient variability and representation to return robust insights. In figure 1, I present

[20] See Laeven & Valencia (2008).

the evolution of the average ownership. The trend is split into two groups: the ownership on high-leverage banks (the 50% banks that present an average leverage ratio above the sample median for the pre-shock period, or 2006-2008) and on low-leverage banks.

Throughout the sample period, Banks and Free Float prefer high leverage banks, whereas Mutual & Pension Funds prefer low leverage banks. Governments changed (or they were forced to change by the need to rescue troubled banks) their ownership preference in 2008. The financial crisis of 2008 and the capital regulatory shock may contribute to explain the dynamics, and in this paper I will try to separate the effect of each of the two explanations.

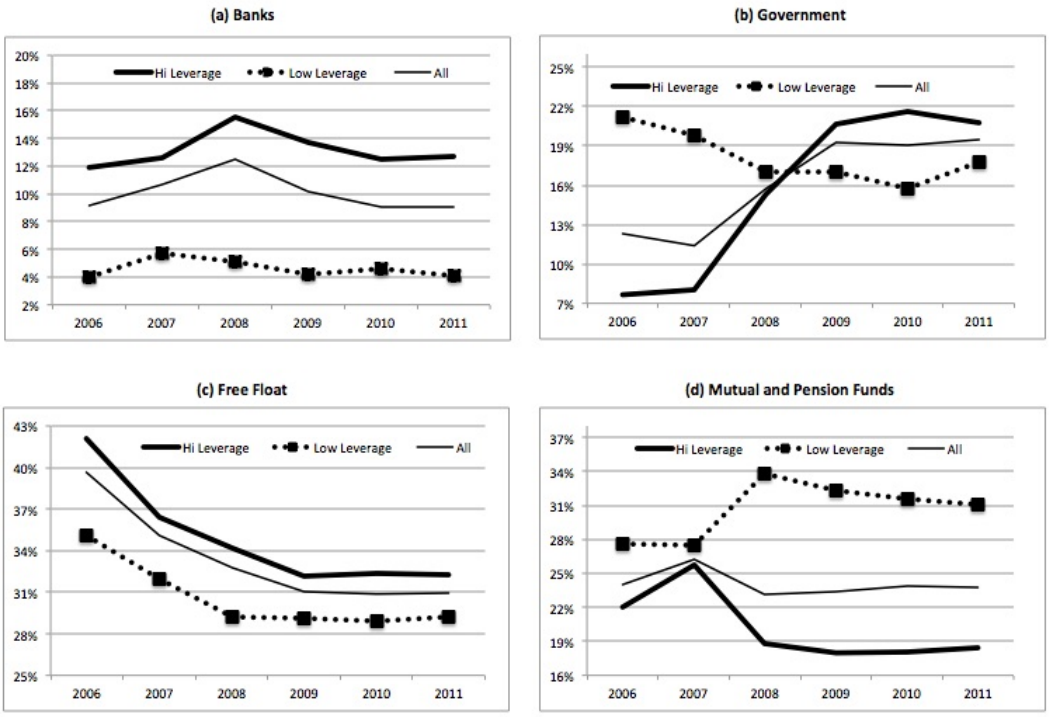

Figure 1. Ownership evolution of some investor types

Variables used are referred and explained in Appendix 2. In **Table 2**, I present some summary statistics for the variables used. Each record contains information on a spe-

cific bank and a specific year (using 234 banks and 6 years, a maximum of 1404 records can be achieved but I do not have full information on all variables for all records).

Table 2

This table reports summary statistics of the main regression variables. Sample consists of the largest 234 banks in the world, all with total assets in 2006 above USD 40 bn. Statistics are based on annual data for the years 2006 to 2011. The meaning of all variables is detailed on appendix 2.

Variables	Mean	Max	Min	Std Dev	# records
Asset Profitability	0,4%	5,7%	-24,5%	1,34%	1 291
Beta	1,03	5,18	-0,23	0,65	957
Credit Rights	2,02	4,00	0,00	0,95	1 282
ROA Volatility	0,61%	10,77%	0,01%	1,05%	1 288
Earnings Volatility	482%	19600%	3%	1905%	1 288
Equity Profitability	6%	1707%	-1199%	74%	1 290
GDP per capita	34 380	114 508	820	17 055	1 294
Idiosyncratic Risk	0,3%	9,4%	-0,1%	0,57%	957
Leverage	21,18	514,19	-259,57	23,48	1 290
Loan to Deposits Gap	1,37	245,62	-0,99	11,59	1 266
Price Volatility	0,45%	10,01%	0,00%	0,79%	957
Ownership of controlling shareholder	48,1%	100,0%	5,0%	36,28%	1 294
Av. Revenue Growth	3,81%	372,31%	-277,26%	34,75%	1 222
Percentage of Fee Income	28,8%	130,6%	-66,7%	18,36%	1 285
Size of Assets	402 467	3 654 046	40 293	580 630	1 294
Own. Broker Type	0,6%	14,8%	0,0%	1,5%	1 294
Own. Bank Type	9,4%	100,0%	0,0%	23,5%	1 294
Own. Employee Type	0,3%	11,6%	0,0%	1,2%	1 294
Own. Financial Conglomerate Type	1,6%	100,0%	0,0%	10,1%	1 294
Own. Foundation Type	4,5%	100,0%	0,0%	18,3%	1 294
Own. Free Float Type	33,1%	100,0%	0,0%	27,1%	1 294
Own. Family Type	3,7%	100,0%	0,0%	13,7%	1 294
Own. Government Type	16,1%	100,0%	0,0%	32,5%	1 294
Own. Non-Financial Firm Type	3,1%	99,9%	0,0%	9,6%	1 294
Own. Insurance Company Type	2,1%	100,0%	0,0%	5,6%	1 294
Own. Mutual & Pension Fund Type	19,7%	92,4%	0,0%	23,0%	1 294
Own. Private Banking Type	0,2%	6,6%	0,0%	0,6%	1 294
Own. Private Equity Type	2,0%	100,0%	0,0%	12,9%	1 294
Own. Sovereign Fund Type	1,6%	99,8%	0,0%	6,5%	1 294
Own. Trust & Nominees Type	1,9%	87,0%	0,0%	8,6%	1 294
WGI Index	6,13	11,41	-4,58	3,73	1 294
Z score	28,54	466,51	-39,41	41,16	1 282
Z1 score	2,25	26,16	-0,79	2,97	1 282
Z2 score	26,30	464,43	-41,61	39,48	1 282

Appendix 3 presents the correlation matrix among variables. I decided to drop the split of Z score into Z1 and Z2: Z1 has no time variability by construction and Z2 is strongly correlated with the Z score. The WGI Index is strongly correlated with GDP per capita, and was also dropped. Price Volatility, Beta and Idiosyncratic Risk are also not used to avoid removing non-listed banks from the regressions.

4 Methodology and Empirical Tests

4.1 Methodology

I use a Difference-in-Differences (DiD) methodology to address the first question: Was there a significant change in the type of shareholders in response to regulatory shocks? The test uses a regression equation of the following type:

$$OwnerType_{i,t} = \alpha + \beta \times \mu_t + \gamma \times D_{i,t} + \delta \times \mu_t \times D_{i,t} + \theta \mathbf{C}_{i,t} + \epsilon_{i,t} \qquad (1)$$

The subscript i denotes the bank and the subscript t denotes the year. *OwnerType* is the percentage combined stake of all shareholders of a given type. I use one regression equation for each investor type. The μ variable takes a value of one for the years after the shock (2009 to 2011) and zero otherwise; the variable is not used in fixed effect models. **C** represents a matrix of time control variables for the country and the bank. Control variables on banks and country of incorporation are explained in detail in appendix 2. I did not use market variables to keep non-listed banks in the sample.

The variable under investigation is D, which is a dummy that takes the value of 1

if the bank in question does not comply with the capital adequacy rule (and so it will suffer a "treatment"). It will take the value zero otherwise[21].

The D dummy variable uses the leverage ratio (assets over equity). The lower this ratio, the less restricted the new ruling is for the bank. The top 50% banks in terms of leverage ratio are considered "high-leveraged" and so subject to "treatment" (D dummy equal to 1). I prefer to use a "crude" leverage ratio measure that is consistent[22] over the entire sample, as reported Tier I or Core Capital are not consistent: most banks disclose the ratio according to the rule of its home country regulator. Furthermore, the change in the formula from Basel I to Basel II was not used for all banks starting in the same year. In the end, I expect a significant correlation among the two possible variables in this sample of largest banks in the world.

4.2 Effect on total ownership of investor types

Table 3 shows the test results. Some of the investor types had no sufficient observations to build a significant model. Banks, as shareholders, prefer high leverage banks to invest, and their preference was not affected in the post-crisis years or due to the capital regulatory shock. Free float reveals no preference or reaction to the crisis or the shock. Governments show no prior preference but react strongly to the regulatory shock, increasing their stakes on undercapitalised banks. However, the reaction to the crisis was not significant. Finally, mutual and pension funds had a prior preference for low leverage banks and reacted negatively to the new capital adequacy rules.

My interpretation is that ownership rotation was a response to weak solvency, with

[21] See Appendix 5 for a proof that this coefficient delta is in fact the DiD estimator.

[22] Even with this measure, accounting standards can put consistency into question. However, the use of the largest banks in the world mitigates accounting standards differences.

the government rescuing the system. Institutional investors were more reluctant to convey new capital to a low profitability industry.

This conclusion has evident implications for the stability of the banking system: when some resolution effort is needed, not all investors are eager to do it. And the candidate for the resolution is the taxpayer[23].

4.3 Effect on leverage

Then I regress Leverage on ownership of the various investor types for the years before the shock[24]. With this test I try to see to which investor type is a safer bank associated with.

The test uses a regression equation of the following type:

$$Leverage_{i,t} = \alpha + \beta \times OwnerType_{i,t} + \theta \mathbf{C}_{i,t} + \epsilon_{i,t} \quad (2)$$

As previously, the subscript i denotes the bank, the subscript t denotes the year and *OwnerType* is the percentage combined stake of all shareholders of a given type. *Leverage* is the Assets/Equity ratio, taken from the reported balance sheets of the banks. **C** represents a matrix of time control variables for the country and the bank.

[23]Government ownership is also "undesirable" due to its effects of future bank safety. As Laeven & Valencia (2010) point out, in a pre-crisis period, government ownership is linked to poor asset quality and it is one of the usual initial conditions to the crisis. Also, Brandao Marques *et al.* (2013) show that Government support is linked to reduced market discipline and margins increase (the enhanced charter value due to higher margins seems not to command less risk taking as a strategy to preserve value).

[24]Z score would probably be a better choice, as it uses also earnings volatility and not just leverage. However, since this variable uses an average of profits, I would remove half of the annual observations to consider only the pre-crisis period. The Z-score would be more influenced by the number of observations than by the volatility of the period.

Results are in **Table 4**. Banks are associated with higher leverage, whereas Government and Institutional Investors seem to command low leveraged banks.

The more interesting feature is that the Government has a clear preference for low leverage banks (the ex-ante effect) but had to increase the stake on undercapitalized banks is response to the capital regulatory shock. Evidence shows Governments acted reluctantly to the regulation. Institutional Investors were the main supporters of low leverage banks, and they reacted negatively to the regulatory shock. For the free float, they seem to prefer under capitalised banks but reacted negatively to the shock. However, results are not statistically significant.

4.4 Effect of controlling shareholders

These investor types can have the will to influence the risk profile of the bank they own, but they may not have the power to do so. As such, I repeated the test considering only the ownership percentage of the controlling shareholder. The test uses a regression equation of the following type:

$$Leverage_{i,t} = \alpha + \beta \times ControlStake_{i,t} + \gamma \times InvestorType_{i,t} +$$

$$+ \delta \times ControlStake_{i,t} \times InvestorType_{i,t} + \theta \mathbf{C}_{i,t} + \epsilon_{i,t} \quad (3)$$

ControlStake represents the percentage ownership of the controlling shareholder, defined as the major shareholder with at least 5% of the voting rights. When no such shareholder exists for a given bank and year, I used the free float percentage ownership[25]. *InvestorType* is a vector of dummy variables that takes the vale of 1 for the

[25]This can have a confusing effect on the β coefficient of the regression, as for this Free Float investor type a lower value means a larger stake from other investor types. As such a lower *ControlStake* value in Free Float means more "will" from other investor types, contrasting to less will on all other types.

investor type controlling the bank in any given year and zero for all other types. Results are presented in **Table 5**.

It is fair to say that, when the controlling shareholder is Free Float, it is in fact the management that controls the banks, with the power and the will to shape the risk profile to its own preferences. It is exactly the management, plus the Mutual & Pension Funds that impose a lower leverage to the banks they control. And they are the investors selling their bank shares in response to the capital regulatory shock. The Government commands a higher leverage when it controls the bank.

An interesting issue is that the percentage ownership does not command a different leverage profile when the controlling party is the management or a Mutual or Pension Fund (when the investor has the power to move the risk profile into his preferred habitat, there is no "grading" of the will). Only the Government seems to prefer less leverage when its stake increases. One significant investor group (banks) was removed from the model to avoid collinearity. And so, I can infer that banks do command higher leverage when they control other banks.

4.5 Alternative risk variables

I performed some other tests (not shown) with different variables for risk, like Z score, beta, idiosyncratic risk or price volatility. The first one has a problem of the standard deviation of profits (I have to remove half of the observations to use only the pre-crisis period) and the others need a market for the shares, which also excludes a lot of banks and most occurrences of some investor types.

5 Conclusions

In this paper, I perform a test of the impact of a capital regulatory shock on the ownership profile of banks.

For some years, researchers could not find a clear effect of strict capital adequacy on the risk profile of the banks. At the time, the intuition was that shareholders could impose an increase in the riskiness of the assets, crowding-out the effect of reduced leverage.

When the ownership dimension was added, it becomes apparent that some shareholders might have the will to increase the riskiness of the assets, but they need the power to do so. As such, only diversified block-holders would fight for that. Previous studies, that did not address the ownership profile, could not capture this effect and produced inconclusive results relating capital adequacy and risk profile.

A regulatory recommendation was to take a closer look to financial institutions where diversified block-holders had the power and the will to increase risk even when leverage was reduced.

Our contribution to the discussion is to claim that there are no specific ownership profile that can place a financial institution outside of the supervisor scrutiny. The problem is that different shareholders will move in and out, changing the risk appetite of the ruling power at the bank.

The answer to our first question (was there a significant change in the type of shareholders in response to the recent capital regulatory shock?) is clearly affirmative: there is a significant change in the type of shareholders as a response to this regulatory shock. I find more banks and the government in the ownership list, and much less institutional

shareholders and free float. At this moment, I cannot say that this is a permanent effect (low demand for low leverage banks, if the new rule makes the business less attractive) or a more temporary one (the low demand is due to the uncertainty over the time length of the bad state of the world), as I would need a lot more post-crisis data.

As for our second question (is the banking system in the hands of more "desired" shareholders?), I claim that these new shareholders are not the desired ones, not in regulatory terms nor even for the society. It is not clear that Banks and the Government are associated with less risk profile of the banks they own (evidence suggests the opposite). For the society, bank concentration and government control may not be desired either.

One possible explanation for this crowding-out effect is that regulators are trying to contain idiosyncratic risk (more linked to the riskiness of the assets) with a rule that contains systematic risk (capital adequacy). This has a distorting effect on ownership. Another insight claims that supervisors should be aware of significant ownership movements that cause the crowding-out.

Future research should address this same effect on other regulatory rules, like deposit insurance, liquidity levels, activity restriction, and the discriminatory capital adequacy levels for G-SIFI. Also, the impact of the regulation on the riskiness of assets deserves attention on future research.

Table 3

This table presents regression results of various models. Each model corresponds to a different investor type. Dependent variable is the percentage combined ownership of each investor type in a given bank and in a given year. Independent variables are three dummies and a set of control variables. The first dummy has a value of 1 if the observation corresponds to pre-shock years (2006-2008) and 0 otherwise. The second dummy has a value of 1 if the bank, in that year, has a leverage ratio above the sample median, and 0 otherwise. The third variable is the product of the two previous dummies. Sample consists of the largest 234 banks in the world all with total assets in 2006 above USD 40 bn. Statistics are based on annual data for the years 2006 to 2011. The meaning of all control variables is detailed in appendix 2. T-stats for each coefficient are reported in parenthesis. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

Dependent variable: ownership of	1 - Bank / Bank Holding Co		2 - FreeFloat		3 - Public authority, Government		4 - Mutual & Pension Fund	
Intercept	-0,02240		0,65520		-0,19590		0,03496	
	(-0,292)		*(7,808)* ***		*(-2,081)* **		*(0,545)*	
Investor Type Ownership								
Dummy Treament	0,05367	0,05356	0,01261	0,01294	0,01118	0,01150	-0,12040	-0,12060
	(2,744) ***	*(2,733)* ***	*(0,589)*	*(0,603)*	*(0,465)*	*(0,477)*	*(-7,350)* ***	*(-7,348)* ***
Dummy Shock Years	-0,00681		-0,03337		-0,02739		0,02501	
	(-0,355)		*(-1,588)*		*(-1,161)*		*(1,556)*	
Dummy Cross Effect	0,01034	0,01095	-0,01200	-0,01345	0,09363	0,09414	-0,04551	-0,04598
	(0,385)	*(0,406)*	*(-0,408)*	*(-0,456)*	*(2,834)* ***	*(2,841)* ***	*(-2,021)* **	*(-2,036)* **
Control Variables								
Creditor Rights Index	-0,00518	-0,00522	-0,02769	-0,02760	0,01742	0,01734	-0,05798	-0,05792
	(-0,714)	*(-0,718)*	*(-3,486)* ***	*(-3,472)* ***	*(1,954)* *	*(1,943)* *	*(-9,545)* ***	*(-9,524)* ***
GDP per capita	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000
	(0,280)	*(0,242)*	*(-2,808)* ***	*(-2,717)* ***	*(-6,035)* ***	*(-6,054)* ***	*(8,889)* ***	*(8,901)* ***
Asset Profitability	0,14500	0,17600	-0,34430	-0,42780	-2,93800	-2,96100	1,77000	1,78200
	(0,275)	*(0,329)*	*(-0,596)*	*(-0,731)*	*(-4,534)* ***	*(-4,507)* ***	*(4,007)* ***	*(3,980)* ***
Equity Profitability	-0,01930	-0,01921	0,02686	0,02643	-0,00595	-0,00607	-0,00124	-0,00112
	(-2,129) **	*(-2,113)* **	*(2,704)* ***	*(2,656)* ***	*(-0,534)*	*(-0,543)*	*(-0,163)*	*(-0,147)*
Loan to Deposits Gap	-0,00059	-0,00059	-0,00297	-0,00299	-0,00068	-0,00068	-0,00156	-0,00156
	(-1,017)	*(-1,007)*	*(-4,659)* ***	*(-4,673)* ***	*(-0,947)*	*(-0,944)*	*(-3,197)* ***	*(-3,195)* ***
Percentage of Fee Income	0,09019	0,09097	0,18580	0,18430	-0,35160	-0,35240	0,15590	0,15620
	(2,284) **	*(2,297)* **	*(4,295)* ***	*(4,252)* ***	*(-7,244)* ***	*(-7,242)* ***	*(4,711)* ***	*(4,709)* ***
Log of Size of Assets	0,00749	0,00737	-0,02225	-0,02167	0,04120	0,04120	0,01524	0,01519
	(1,166)	*(1,143)*	*(-3,161)* ***	*(-3,070)* ***	*(5,217)* ***	*(5,201)* ***	*(2,831)* ***	*(2,813)* ***
Earnings Volatility	-0,00037	-0,00037	0,00049	0,00049	-0,00096	-0,00096	0,00027	0,00027
	(-1,053)	*(-1,045)*	*(1,283)*	*(1,267)*	*(-2,243)* **	*(-2,243)* **	*(0,917)*	*(0,918)*
Z_Score	-0,00051	-0,00052	0,00043	0,00043	0,00094	0,00094	-0,00020	-0,00020
	(-3,084) ***	*(-3,082)* ***	*(2,360)* **	*(2,372)* **	*(4,597)* ***	*(4,583)* ***	*(-1,453)*	*(-1,446)*
Fixed Effects								
Year	No	Yes	No	Yes	No	Yes	No	Yes
Statistics								
R Square	0,0458	0,0459	0,0662	0,0677	0,1513	0,1519	0,2857	0,2865
F Statistic	4,91 ***	3,68 ***	7,25 ***	5,56 ***	18,24 ***	13,71 ***	40,94 ***	30,71 ***
# Independent variables	12	16	12	16	12	16	12	16
# Degrees of Freedom	1228	1224	1228	1224	1228	1224	1228	1224
# Observations	1241	1241	1241	1241	1241	1241	1241	1241

Table 4

This table presents regression results of various models. Each model corresponds to a different investor type. Dependent variable is the leverage. Independent variables are the total percentage ownership of a given investor type and a set of control variables. Sample consists of the largest 234 banks in the world all with total assets in 2006 above USD 40 bn. Statistics are based on annual data for the years 2006 to 2008 (the pre shock years). The meaning of all control variables is detailed in appendix 2. T-stats for each coefficient are reported in parenthesis. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	1 - Bank		2 - Free Float		3 - Government		4 - Mutual & Pension Funds	
Intercept	-33,84000		-36,11000		-35,96000		-34,60000	
	(-4,922) ***		*(-5,017)* ***		*(-5,134)* ***		*(-5,031)* ***	
Investor Type Ownership								
Bank / Bank Holding Company	13,31000	13,31000						
	(5,438) ***	*(5,435)* ***						
FreeFloat			1,05200	0,90480				
			(0,469)	*(0,403)*				
Public authority, State, Government					-4,85300	-4,85500		
					(-2,257) **	*(-2,257)* **		
Mutual & Pension Fund							-16,10000	-16,01000
							(-5,346) ***	*(-5,315)* ***
Control Variables								
Credit Rights	2,29200	2,28100	2,31800	2,30300	2,30900	2,29700	1,35200	1,34700
	(3,640) ***	*(3,621)* ***	*(3,585)* ***	*(3,560)* ***	*(3,598)* ***	*(3,579)* ***	*(2,067)* **	*(2,058)* **
GDP per Capita	0,00007	0,00007	0,00007	0,00007	0,00005	0,00005	0,00012	0,00012
	(1,610)	*(1,679)* *	*(1,615)*	*(1,680)* *	*(1,078)*	*(1,145)*	*(2,832)* ***	*(2,885)* ***
Percentage of Fee Income	-4,78700	-4,94700	-3,14800	-3,28600	-4,99500	-5,16200	-0,05106	-0,20840
	(-1,433)	*(-1,478)*	*(-0,921)*	*(-0,960)*	*(-1,426)*	*(-1,471)*	*(-0,015)*	*(-0,062)*
Asset Profitability	0,00000	362,40000	0,00000	347,20000	0,00000	329,00000	0,00000	408,40000
	(4,454) ***	*(4,127)* ***	*(4,183)* ***	*(3,867)* ***	*(3,979)* ***	*(3,664)* ***	*(4,934)* ***	*(4,608)* ***
Earnings Volatility	-0,01818	-0,01947	-0,02203	-0,02319	-0,02770	-0,02904	-0,01741	-0,01857
	(-0,585)	*(-0,626)*	*(-0,692)*	*(-0,728)*	*(-0,872)*	*(-0,912)*	*(-0,560)*	*(-0,596)*
Equity Profitability	-31,96000	-31,94000	-32,52000	-32,49000	-32,41000	-32,39000	-32,66000	-32,64000
	(-14,119) ***	*(-14,105)* ***	*(-14,042)* ***	*(-14,023)* ***	*(-14,066)* ***	*(-14,051)* ***	*(-14,430)* ***	*(-14,413)* ***
Log of Size of Assets	4,08900	4,12800	4,32000	4,35400	4,50900	4,54700	4,40600	4,44000
	(7,090) ***	*(7,146)* ***	*(7,301)* ***	*(7,350)* ***	*(7,587)* ***	*(7,641)* ***	*(7,644)* ***	*(7,691)* ***
Loans to Deposits Gap	0,04492	0,04383	0,04159	0,04016	0,03689	0,03575	0,01401	0,01319
	(1,125)	*(1,097)*	*(1,011)*	*(0,975)*	*(0,907)*	*(0,878)*	*(0,348)*	*(0,328)*
Fixed Effects								
Year								
Statistics								
R Square	0,3716	0,3733	0,3426	0,3443	0,3476	0,3494	0,3706	0,3721
F Statistic	41,78 ***	34,34 ***	36,83 ***	30,26 ***	37,65 ***	30,95 ***	41,62 ***	34,16 ***
# Independent variables	9	11	9	11	9	11	9	11
# Degrees of Freedom	636	634	636	634	636	634	636	634
# Observations	645	645	645	645	645	645	645	645

Table 5

This table reports results of a linear regression of *Leverage*, as the dependent variable, on several regressors. Independent variables are the *Percentage Ownership of the Controlling Shareholder*, *Investor Types*, as a factor, the cross effect of the *Percentage Ownership of the Controlling Shareholder* with *Investor Types*, and a set of control variables. Sample consists of the largest 234 banks in the world, all with total assets in 2006 above USD 40 bn. Statistics are based on annual data for the years 2006 to 2008. In each year, a controlling shareholder type is attributed to each bank, being the bank considered widely-held if the major shareholder has less than 5% of the voting rights. The meaning of all variables is detailed on Appendix 2. T-stats for each coefficient are reported in parenthesis. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	Leverage		Fixed Effects	
	(1)		(2)	
Intercept	-34,8			
	(-5,281)	***		
% Ownership of the Controlling Owner	14,76		14,7	
	(5,073)	***	(5,053)	***
Bank / Bank Holding Company				
FreeFloat	-13,07		-13,06	
	(-2,864)	***	(-2,862)	***
Public authority, State, Government	9,943		10,28	
	(3,571)	***	(3,682)	***
Mutual & Pension Fund	-6,985		-7,022	
	(-2,391)	**	(-2,403)	*
Cross Effects: Investor Type * % Ownership				
Bank / Bank Holding Company				

Table 5 (continued)

FreeFloat	5,632		5,456	
	(0,852)		(0,826)	
Public authority, State, Government	-22,53		-22,87	
	(-5,380)	***	(-5,457)	***
Mutual & Pension Fund	5,513		6,163	
	(0,290)		(0,324)	
Credit Rights	-34,8		-34,29	
	(-5,281)	***	(-5,191)	***
GDP per Capita	2,249		2,249	
	(4,035)	***	(4,032)	***
Asset Profitability	0,0001046		-1,292	
	(2,811)	***	(-1,011)	
Loan to Deposits Gap	-218,4		-225,5	
	(-2,619)	***	(-2,627)	***
Percentage of Fee Income	0,02379		0,02345	
	(0,682)		(0,672)	
Log of Size of Assets	0,04702		-0,03339	
	(0,015)		(-0,011)	
Earnings Volatility	4,055		4,092	
	(7,617)	***	(7,681)	***
Equity Profitability	-0,02972		-0,02998	
	(-1,119)		(-1,129)	
Growth in Revenues (pre crisis)	-9,994		-10	
	(-4,315)	***	(-4,321)	***
Year Fixed Effects	No		Yes	

Table 5 (continued)

Statistics				
R Square	0,3928		0,3954	
F Statistic	12,03	***	11,41	***
# Independent variables	32		34	
# Degrees of Freedom	595		593	
# Observations	627		627	

Appendices

Appendix 1 - List of Banks

Rank	Bank	Country	Assets 2006	Assets 2011
1	Deutsche Bank	DE	2 091 055	2 804 894
2	Japan Post bank	JP	2 080 882	2 546 092
3	Barclays Plc	GB	1 952 506	2 430 190
4	UBS	CH	1 925 033	1 512 805
5	BNP Paribas	FR	1 900 821	2 547 203
6	Citigroup	US	1 884 167	1 873 878
7	HSBC Holdings Plc	GB	1 860 758	2 555 579
8	Credit Agricole	FR	1 821 059	2 436 067
9	Royal Bank of Scotland Group	GB	1 706 961	2 342 123
10	ING Group	NL	1 618 357	1 658 007
11	Mitsubishi UFJ Financial	JP	1 586 843	2 798 108
12	Bank of America	US	1 459 737	2 129 046
13	JP Morgan Chase	US	1 351 520	2 265 792
14	ABN Amro	NL	1 302 628	524 508
15	Societe Generale	FR	1 262 743	1 531 176
16	Mizuho Financial	JP	1 258 861	2 150 052
17	HBOS - Halifax Bank of Scotland	GB	1 159 243	0
18	Morgan Stanley	US	1 121 192	749 898
19	Banco Santander	ES	1 100 462	1 622 102
20	UniCredit	IT	1 086 488	1 201 185
21	Credit Suisse	CH	1 029 388	1 118 394
22	Industrial and Commercial Bank of China (ICBC)	CN	962 105	2 458 597
23	Sumitomo Mitsui Financial	JP	847 122	1 859 845
24	Merrill Lynch	US	841 299	555 788
25	Goldman Sachs	US	838 201	923 225
26	Commerzbank AG	DE	802 744	857 711
27	Intesa Sanpaolo	IT	761 182	828 494
28	Dexia Group	BE	747 931	534 977
29	Rabobank	NL	734 354	948 311
30	Dresdner Bank AG	DE	732 298	0
31	Wachovia Corporation	US	707 121	0
32	China Construction Bank	CN	698 124	1 951 046
33	Agricultural Bank of China	CN	687 248	1 855 056
34	Bank of China	CN	683 199	1 879 280
35	Lloyds Banking Group	GB	673 040	1 508 520
36	Natixis	FR	605 258	658 046
37	Norinchukin Bank	JP	573 174	939 577
38	National Westminster Bank	GB	569 347	571 286
39	DZ Bank AG	DE	556 496	526 121
40	Landesbank Baden-Wurttemberg	DE	550 691	483 522

Appendix 1 - List of Banks (cont.)

Rank	Bank	Country	Assets 2006	Assets 2011
41	Banco Bilbao Vizcaya Argentaria	ES	543 272	774 663
42	Lehman Brothers	US	503 545	0
43	Danske Bank	DK	484 808	597 210
44	Wells Fargo	US	481 996	1 313 867
45	Bayerische Landesbank	DE	466 142	400 682
46	Royal Bank Canada	CA	460 479	736 025
47	Nordea Bank	SE	457 791	928 272
48	Banque Federative du Credit Mutuel	FR	447 411	495 369
49	KfW Bankengruppe	DE	441 293	641 334
50	KBC Group	BE	429 430	369 884
51	National Australia Bank	AU	382 253	769 511
52	Bear Stearns	US	350 433	0
53	Washington Mutual	US	346 288	0
54	Toronto Dominion Bank	CA	337 063	672 045
55	Resona Holdings	JP	335 845	561 693
56	Bank of Nova Scotia	CA	325 132	563 259
57	Commonwealth Bank of Australia	AU	301 877	681 858
58	Nomura Holdings	JP	301 305	464 144
59	China Development Bank	CN	296 530	993 091
60	EuroHypo	DE	296 051	263 084
61	Depfa	IE	294 221	0
62	Skandinaviska Enskilda Banken (SEB)	SE	282 462	343 050
63	Fortis Bank Nederland	NL	276 806	0
64	La Caixa	ES	275 980	366 026
65	BMO - Bank of Montreal	CA	274 494	467 466
66	Nationwide Building Society	GB	269 098	304 843
67	Standard Chartered	GB	266 102	599 070
68	ANZ Banking	AU	263 864	606 913
69	Svenska Handelsbanken	SE	261 372	356 366
70	Canadian Imperial Bank of Commerce (CIBC)	CA	260 774	346 322
71	Norddeutsche Landesbank	DE	257 171	295 031
72	HSH Nordbank	DE	256 472	176 148
73	Cassa Depositi e Prestiti	IT	249 530	372 166
74	Bank of Ireland	IE	249 177	200 740
75	Deutsche Postbank AG	DE	243 995	248 828
76	Erste Group	AT	239 793	272 189
77	Westpac Banking	AU	237 702	684 236
78	BPCE - Banque Populaire et Caisse d'Epargne	FR	230 428	1 475 474
79	Woori Financial Group	KR	228 379	270 090
80	Bank of Communications	CN	220 319	0

Appendix 1 - List of Banks (cont.)

Rank	Bank	Country	Assets 2006	Assets 2011
81	U.S. Bancorp	US	219 232	340 122
82	Shinkin Central Bank	JP	219 062	393 297
83	DnB NOR	NO	211 727	355 826
84	Kookmin Bank	KR	210 291	222 544
85	Helaba - Landesbank Hessen Thuringen	DE	209 810	212 541
86	Banca Monte Dei Paschi di Siena	IT	209 246	311 974
87	Allied Irish Banks (AIB)	IE	209 207	177 113
88	Countrywide Financial Corporation	US	199 946	0
89	Northern Rock Building Society	GB	197 860	30 144
90	Swedbank AB	SE	197 560	269 640
91	Shinhan Financial Group	KR	191 459	248 785
92	Landesbank Berlin (LBB)	DE	186 903	170 016
93	SunTrust Bank	US	182 162	176 859
94	Capitalia	IT	180 973	0
95	Bankia	ES	180 736	386 713
96	NRW.BANK	DE	178 888	197 715
97	Nykredit Realkredit A/S	DK	169 398	242 920
98	Citizens Financial	US	160 831	129 654
99	State Bank of India	IN	157 441	310 543
100	Capital One	US	149 739	206 019
101	La Banque Postale	FR	148 268	240 701
102	Regions Financial	US	143 369	127 050
103	National City Corporation	US	140 191	0
104	Banco Brasil	BR	138 717	525 621
105	Standard Bank Group	ZA	137 265	185 096
106	Alliance & Leicester Plc	GB	134 289	0
107	Sberbank of Russia	RU	131 685	337 153
108	DBS Group	SG	128 347	262 878
109	Caixa Geral de DepÛsitos	PT	127 016	156 264
110	Hana Financial Group	KR	125 070	153 898
111	Bradesco	BR	124 296	386 805
112	BB&T Corp.	US	121 351	174 579
113	Daiwa Securities Group	JP	121 042	246 054
114	Banco Popular Espanol	ES	120 951	169 693
115	China Merchants Bank	CN	119 688	443 999
116	Bank Nederlandse Gemeenten	NL	118 902	176 866
117	China CITIC Bank	CN	118 800	0
118	Industrial Bank of Korea	KR	114 051	160 587
119	Desjardins Group	CA	110 783	186 172
120	Landwirtschaftliche Rentenbank	DE	109 165	115 193

Appendix 1 - List of Banks (cont.)

Rank	Bank	Country	Assets 2006	Assets 2011
121	Macquarie Bank	AU	107 543	156 837
122	State Street	US	107 353	216 673
123	Cathay Financial Holdings	TW	105 817	165 331
124	SNS Reaal	NL	105 236	171 311
125	United Overseas Bank Limited UOB	SG	104 898	182 753
126	Bancaja	ES	104 879	0
127	Millennium bcp	PT	104 316	121 162
128	Bank of New York Mellon	US	103 206	325 266
129	PNC Financial Services	US	101 820	271 205
130	National Bank of Greece	GR	100 837	138 514
131	Fifth Third Bancorp	US	100 669	116 967
132	Oversea-Chinese Banking Corporation Limited OCBC	SG	98 335	214 220
133	Itau Unibanco	BR	98 152	456 038
134	UBI Banca	IT	98 033	168 239
135	Anglo Irish Bank	IE	96 721	71 987
136	Banco Sabadell	ES	96 048	130 176
137	Bank of Yokohama	JP	95 768	166 456
138	China Minsheng Banking Corp CMBC	CN	92 906	354 101
139	Shoko Chukin Bank Ltd	JP	92 364	160 233
140	KeyCorp	US	92 337	88 785
141	Shinsei Bank Limited	JP	91 027	111 945
142	Banco Popolare	IT	90 657	173 842
143	Banco Popolare di Verona e Novara	IT	90 657	0
144	Sovereign Bank	US	89 642	0
145	Caixa Catalunya	ES	89 148	99 188
146	ICICI Bank Limited	IN	89 075	113 859
147	Oesterreichische Volksbanken AG	AT	88 986	53 315
148	Shanghai Pudong Development Bank	CN	88 328	426 480
149	Myanma Economic Bank	MM	88 250	0
150	Hang Seng Bank	HK	86 020	125 610
151	FirstRand Banking Group	ZA	86 011	86 270
152	St. George Bank Limited	AU	84 371	0
153	IKB Deutsche Industriebank	DE	83 860	40 949
154	Caja de Ahorros del Mediterraneo CAM	ES	82 143	0
155	Chiba Bank Ltd.	JP	81 782	141 942
156	Espírito Santo Financial Group (ESFG)	PT	81 652	108 898
157	Hokuhoku Financial Group	JP	80 952	138 205
158	Industrial Bank	CN	79 116	0
159	OP-Pohjola Group	FI	78 568	119 613
160	Banco Espírito Santo	PT	78 046	103 995

Appendix 1 - List of Banks (cont.)

Rank	Bank	Country	Assets 2006	Assets 2011
161	Zurich Cantonal Bank	CH	78 030	142 841
162	CIT Group, Inc	US	77 486	45 235
163	China Everbright Bank Co	CN	76 381	275 353
164	Raiffeisen Bank International (RZB Group)	AT	73 728	190 507
165	Shizuoka Bank	JP	73 290	126 063
166	Taiwan Cooperative Bank	TW	72 849	91 037
167	Taishin Financial Holding Co., Ltd	TW	71 534	86 605
168	EFG Eurobank Ergasias	GR	71 026	99 569
169	Britannia Building Society	GB	68 850	0
170	Mega Financial Holding Company	TW	68 697	86 487
171	Bank Leumi Le Israel	IL	68 597	95 786
172	Bank Hapoalim	IL	67 061	93 386
173	BAWAG PSK Group	AT	67 049	53 240
174	Verband der Sparda-Banken e.V.	DE	66 061	0
175	Alpha Bank	GR	65 721	76 662
176	Malayan Banking Berhad - Maybank	MY	63 118	130 359
177	Joyo Bank Ltd.	JP	62 529	104 086
178	Mediobanca	IT	60 861	97 716
179	Bankinter	ES	60 806	77 106
180	Northern Trust	US	60 712	100 224
181	Banca Popolare dell'Emilia Romagna	IT	59 727	78 398
182	Turkiye is Bankasi A.S. - ISBANK	TR	58 569	97 218
183	Nishi-Nippon City Bank Ltd	JP	58 398	99 739
184	Comerica	US	58 001	61 008
185	North Fork Bank	US	57 903	0
186	Arion Banki hf	IS	57 134	7 287
187	Manufacturers and Traders Trust Company	US	57 065	77 924
188	Hua Xia Bank co., Limited	CN	57 011	197 640
189	Land Bank of Taiwan	TW	56 725	75 515
190	Caja de Ahorros de Galicia - Caixa Galicia	ES	56 500	93 625
191	M&I LLC - Marshall & Ilsley Corporation	US	56 230	0
192	Aozora Bank	JP	54 964	66 278
193	Banque et Caisse d'Epargne de l'Etat Luxembourg	LU	54 448	51 508
194	Bank of Kyoto	JP	54 087	95 687
195	Banca Popolare di Milano	IT	53 027	67 308
196	Fubon Financial Holding Co Ltd	TW	52 930	119 509
197	Banca Lombarda e Piemontese SpA	IT	52 457	0
198	VTB Bank	RU	52 403	211 270
199	Chinatrust Financial Holding Company	TW	52 379	66 709
200	Hiroshima Bank Ltd	JP	51 841	86 474

Appendix 1 - List of Banks (cont.)

Rank	Bank	Country	Assets 2006	Assets 2011
201	Hua Nan Financial Holdings Co Ltd	TW	51 399	65 236
202	CorealCredit Bank AG	DE	51 241	12 597
203	Hachijuni Bank	JP	51 042	85 831
204	T.C. Ziraat Bankasi A.S.	TR	50 722	86 085
205	North Pacific Bank-Hokuyo Bank	JP	50 407	100 202
206	Ibercaja	ES	49 547	58 632
207	Gunma Bank Ltd	JP	49 199	84 004
208	First Financial Holding Company Limited	TW	49 138	68 736
209	Charles Schwab	US	48 992	108 553
210	Chugoku Bank, Ltd.	JP	48 483	82 423
211	Guangdong Development Bank	CN	47 909	145 986
212	The 77 Bank	JP	47 436	99 035
213	AgriBank, FCB	US	47 007	73 110
214	Zions Bancorporation	US	46 970	53 149
215	Banco Português de Investimento	PT	46 935	55 675
216	Sal. Oppenheim jr. & Cie S.C.A.	DE	46 647	0
217	Shin Kong Financial Holding Co.,Ltd	TW	45 804	70 561
218	Commerce Bancorp, Inc.	US	45 316	0
219	Credit Immobilier de France Dveloppement - CIFD	FR	45 099	52 950
220	Hamburger Sparkasse - HASPA	DE	44 818	49 997
221	CIMB Group Holdings Berhad	MY	44 170	94 995
222	Investec Group	GB	43 646	70 386
223	NIBC Holding NV	NL	43 070	36 624
224	Akbank T.A.S.	TR	42 551	73 947
225	Munchener Hypothekenbank eG	DE	42 141	48 407
226	Bangkok Bank Public Company Limited	TH	41 725	66 791
227	Portman Building Society	GB	41 685	0
228	Chang Hwa Commercial Bank Ltd.	TW	41 609	52 489
229	Public Bank Berhad	MY	41 591	78 923
230	National Commercial Bank	SA	41 517	80 315
231	Cobank, ACB	US	41 379	63 290
232	Hypo Alpe-Adria-Group	AT	40 920	45 536
233	Piraeus Bank	GR	40 820	63 965
234	Turkiye Garanti Bankasi A.S.	TR	40 293	86 403

Appendix 2 - Variables used

Variable	Comment
Ownership	
Type of Investor	BD - brokers, BK - banks, EM - employees, FC - financial conglomerates, FD - foundations, FF - free float, FM - families, GV - government, IC - non-financial firms, IS - insurance companies, MP -mutual & pension funds, PB - private banks, PE - private equity, SF - Sovereign Funds and TR - trusts & nominees.
Ownership	Direct ownership rights as a percentage. As a rule, I used only common stock (a couple of banks do not have common stock, and so I use the most similar capital instrument).
Bank	
Asset Size	Log of total assets in USD Bn. Numbers were collected from the consolidated annual reports.
Asset Profitability	Annual profit over year-end total assets. Numbers were collected from the consolidated annual reports.
Equity Profitability	Annual profit over year-end total equity. Numbers were collected from the consolidated annual reports.
Share of Fee	Percentage of fee income on total NIM plus fees. This variable captures distinctive characteristics of commercial and investment banks. Numbers were collected from the consolidated annual reports.
Leverage	The ratio of total assets over total equity. Numbers were collected from the consolidated annual reports.
Country	Country of incorporation.
Loan to Deposits gap	Net loans granted to clients as a percentage of total deposits from clients. Numbers were collected from the consolidated annual reports.

Appendix 2 - Variables used (cont.)

Variable	Comment
Bank	
Price Volatility	Variance of weekly returns of the stock, adjusted for splits and dividends. Adjusted prices were taken from Datastream.
Beta	Beta coefficient calculated with weekly bank stock returns against weekly returns of the MSCI World Index. For each year beta I only consider the weekly returns of that same year.
Idiosyncratic Risk	Diversifiable risk of the stock, computed as Price Volatility less the product of the square of beta by the variance of the weekly return of the MSCI World Index.
Earnings Volatility	Standard deviation of profits in the 6 years of data. Numbers to compute the variable were collected from the consolidated annual reports.
Average Revenue Growth	3-year arithmetic average growth rate in earnings (Net Interest Margin + Fees) for pre-shock years (2006-2008). Numbers to compute the variable were collected from the consolidated annual reports.
Z-Score, Z1 and Z2 scores	See Boyd & Graham (1986). It is a score that represents the number of standard deviations of profits over total assets needed to wipe out equity over total assets (assumes a normal distribution of returns). A high score means a safer bank. See Appendix 4 for an explanation of the variable and the decomposition on Z1 and Z2 scores.
Country	
Creditor Rights	Creditor Rights Index, collected from Djankov & Shleifer (2007). This variable measures the legal rights of the creditors against defaulting debtors in each country.

Appendix 2 - Variables used (cont.)

Variable	**Comment**
Bank	
Country	
WGI Index	Worldwide Governance Indicator for each country prepared by Kaufmann *et al.* (2010). The variable incorporates different issues like accountability, violence, corruption, rule of law, quality of regulation and government effectiveness.
GDP per capita	Values in current USD. The source is the World Bank.

Appendix 3 - Correlation Matrix for control variables

	Asset Profitability	Beta	Credit Rights	ROA Volatility	Earnings Volatility	Equity Profitability	GDP per capita	Gov41	Idiosyncratic Risk	Leverage
Beta	-0,1420									
Credit Rights	0,0233	-0,2061								
ROA Volatility	-0,3907	0,1398	-0,1500							
Earnings Volatility	-0,0760	0,0575	-0,0090	0,0792						
Equity Profitability	0,1969	-0,0214	-0,0238	-0,0779	-0,0210					
GDP per capita	-0,1852	0,2230	-0,0893	0,0978	0,0455	-0,0685				
Gov41	0,1099	0,1688	-0,1168	-0,0761	0,0287	-0,0028	0,4091			
Idiosyncratic Risk	-0,3014	0,4891	-0,0375	0,1722	0,0282	0,0263	0,0625	0,1006		
Leverage	-0,0950	-0,0700	0,0869	-0,0423	-0,0124	-0,6223	0,0979	-0,0972	-0,2146	
Loan to Deposits Gap	-0,0349	0,0697	-0,0831	-0,0146	-0,0019	-0,0069	0,0465	-0,0278	0,2177	0,0138
Price Volatility	-0,3006	0,6399	-0,0759	0,1664	0,0404	0,0000	0,1202	0,1297	**0,9620**	-0,1648
% of controlling shareholder	-0,1123	-0,1684	0,1713	0,0307	0,0114	-0,0346	0,0254	-0,2207	0,0465	0,1099
Average Revenue Growth	0,0336	-0,0099	-0,1491	0,0301	-0,0488	0,0204	-0,0912	-0,0010	-0,0134	-0,0107
Percentage of Fee Income	0,0420	0,1845	-0,1478	-0,0221	-0,0395	0,0074	0,2108	0,0711	-0,0403	0,0191
Size of Assets	-0,0261	0,2332	-0,0202	-0,1148	-0,0165	0,0073	0,1538	0,0700	0,0351	0,1021
WGI Index	-0,2106	0,1494	0,0520	0,0191	0,0530	-0,0744	**0,8016**	0,3744	0,0052	0,1589
Z score	0,0919	-0,1839	0,1070	-0,2585	-0,1212	0,0274	-0,0950	-0,0034	-0,1328	-0,0681
Z1 score	0,2627	-0,1892	0,0822	-0,3093	-0,1774	0,0770	-0,2921	0,1478	-0,1406	-0,1067
Z2 score	0,0761	-0,1806	0,1053	-0,2463	-0,1130	0,0228	-0,0772	-0,0116	-0,1299	-0,0630

Appendix 3 - Correlation Matrix for control variables (cont.)

	Loan to Deposits Gap	Price Volatility	% of controlling shareholder	Average Revenue Growth	Percentage of Fee Income	Size of Assets	WGI Index	Z score	Z1 score
Beta									
Credit Rights									
ROA Volatility									
Earnings Volatility									
Equity Profitability									
GDP per capita									
Gov41									
Idiosyncratic Risk									
Leverage									
Loan to Deposits Gap									
Price Volatility	0,1839								
% of controlling shareholder	0,1447	-0,0044							
Average Revenue Growth	-0,0271	-0,0190	0,0166						
Percentage of Fee Income	-0,0562	-0,0072	-0,1953	0,0877					
Size of Assets	-0,0536	0,0903	-0,0824	0,0855	0,2190				
WGI Index	0,0518	0,0517	-0,0026	-0,1679	0,1993	0,0958			
Z score	0,0776	-0,1504	0,1134	0,0252	-0,1564	-0,0893	-0,0480		
Z1 score	-0,0235	-0,1580	-0,0684	0,0551	-0,0972	-0,0640	-0,2901	0,5897	
Z2 score	0,0826	-0,1472	0,1234	0,0222	-0,1557	-0,0883	-0,0283	**0,9982**	0,5396

Appendix 4 - Z-Score variable

In our paper I use the Z-score as a measure of bank fragility, or probability of default. I follow the original methodology proposed by Boyd & Graham (1986). Considering a random variable Profit that can wipe out Equity in a single year, the probability of that event is:

$$P(\Pi < -E) \tag{4}$$

Dividing both sides by the level of assets (there is also a variation dividing both sides by the level of equity), the resulting equation is:

$$P(\frac{\Pi}{A} < -\frac{E}{A}) = P(\pi < k) = \int_{-\infty}^{Z} N(0,1)\,\mathrm{d}Z \tag{5}$$

Assuming that the random variable "return on assets" π follows a normal distribution, the Z-score is computed as:

$$Z = -\frac{k - \bar{\pi}}{\sigma_\pi} \tag{6}$$

with the usual notation for the average and the standard deviation of return on assets. Bear in mind that k is a negative value in a solvent bank. The higher the Z-score, the safer the bank.

However, it is important to distinguish two components of the Z-score: the intrinsic risk of the assets (call it Z1) and the level of coverage of that risk (call it Z2). The variable Z1 is a constant during all the period of analysis, whereas Z2 will change every year. The Z-score is the summation of Z1 and Z2.

$$Z1 = \frac{\bar{\pi}}{\sigma_\pi}; Z2 = -\frac{k}{\sigma_\pi}; Z = Z1 + Z2 \tag{7}$$

In some papers, it is used the concept of ZP-score, which is a weighted average of Z-scores for a given population of banks (for instance, banks of a country, or banks owned by the State). The weights used are the level of assets of each bank. If the ZP-score is higher than the simple average Z-scores, it means that large banks are safer than smaller banks.

Appendix 5 - Proof of the DiD estimator

It is straightforward to prove that the coefficient δ is the DiD estimator. Ignoring the impact of control variables, and considering that

$$E[\epsilon_{i,t}] = 0 \tag{8}$$

I can say that:

$$E[OwnerType_{i,t}|t \leqslant 2008] = \alpha + \beta \times 0 + \gamma \times D_{i,t} + \delta \times 0 \tag{9}$$

Also, for $t \geqslant 2009$:

$$E[OwnerType_{i,t}|t \geqslant 2009] = \alpha + \beta \times 1 + \gamma \times D_{i,t} + \delta \times D_{i,t} \tag{10}$$

For the treated case, or $D_{i,t} = 1$, the difference is:

$$E[OwnerType_{i,t}|D_{i,t} = 1, t \geqslant 2009] - E[OwnerType_{i,t}|D_{i,t} = 1, t \leqslant 2008] =$$

$$= \alpha + \beta + \gamma + \delta - \alpha - \gamma = \beta + \delta \tag{11}$$

And for the non-treated case, the difference is:

$$E[OwnerType_{i,t}|D_{i,t} = 0, t \geqslant 2009] - E[OwnerType_{i,t}|D_{i,t} = 0, t \leqslant 2008] =$$

$$= \alpha + \beta + \gamma \times 0 + \delta \times 0 - \alpha - \delta \times 0 = \beta \tag{12}$$

To conclude the proof, the Difference-in-Differences subject of interest is:

$$(E[OwnerType_{i,t}|D_{i,t} = 1, t \geqslant 2009] - E[OwnerType_{i,t}|D_{i,t} = 1, t \leqslant 2008])-$$

$$-(E[OwnerType_{i,t}|D_{i,t} = 0, t \geqslant 2009] - E[OwnerType_{i,t}|D_{i,t} = 0, t \leqslant 2008]) =$$

$$= \delta \tag{13}$$

How banks adjust to a new target capital ratio

Gonçalo Leónidas Rocha

PhD student at NOVA School of Business and Economics

goncalo.l.rocha@novasbe.pt

January 2015

ABSTRACT

Based on the 184 largest banking groups in the world, I use the five year period after the global financial crisis (2008-2013) to observe how banks comply with the emerging regulation of Basel III.

Banks target higher ratios than required, pointing to the conclusion that regulation may not be binding of the optimal capital structure. The explanation can be found on the value of flexibility or some market friction. More interesting, banks increase equity even when they can avoid it.

Most of the adjustment to higher ratios is done through retained earnings. Despite some interaction with the asset side, only groups of banks with lower initial ratios or reduced profitability, namely European banks, use that interdependence to meet ratios. Size (or even higher requirements of the SIFI group) does not explain bank behavior towards higher capital ratios.

It is also evident the correlation between assets and liabilities to meet a given capital target. Regulation allows banks to play with the relationship, since the requirement is a ratio. It is fair to say that regulation is not imposing a low risk strategy, as the requirements can be achieved with various combinations of capital and risk profiles.

JEL Classification: G280

Keywords: Bank, Regulation, Capital Adequacy, Basel III

1 Introduction

Since the famous seminal paper from Profs. Franco Modgliani and Merton Miller, finance theory defends that an optimal capital structure for a firm only exist in the presence of market frictions[26], namely the impact of corporate taxes, personal taxes, financial distress and so on. This was to be known as the trade off theory of capital structure. In the banking industry, the irrelevance proposition would render Basel regulation also irrelevant, as no bank would try to extract value from increased leverage.

The competing theory, known as the pecking order theory, rests on sticky dividend policy, a preference for internal generated funds and a tendency to issue equity only as a last resort[27]. Can this pecking order theory be present in practice when banks adjust to new Basel capital levels?

Another important part of the capital structure theory is the interaction between assets and liabilities. Is the capital structure policy decided after the investment policy has been settled?

From the early days of the irrelevant proposition, theory has evolved to accept that there is some interaction between assets and liabilities. In banks, this is certainly the case, as regulation calls for a minimum ratio between capital and assets. The amount of credit and market risk is adjusted by each bank to the target capital ratio.

Due to regulatory pressure, capital is the theme (or, in banking parlance, TLAC - Total Loss Absorbing Capacity) where equity and only some forms of liabilities are included. Senior bonds, money market funding and customer deposits[28] are removed

[26]The famous irrelevance proposition from Modigliani & Miller (1958).

[27]On those theories, see for instance Myers (1984).

[28]It is defensible that customer deposits are not proper financing decisions, like suppliers funding is absent from most of the discussions around capital structure of non-financial firms.

from this discussion of banking capital structure.

Basel III, in the wake of the global financial crisis of 2008, asks banks to run at a much higher level of capital, directing to better quality capital (closer to equity than subordinated loans). As such, the regulation gives us a good experimental field on the capital structure theories applied to banks.

For a good discussion of the evolution of Basel Accords and possible future paths to strengthen banks, see Rochet chapter "The Future of Banking Regulation" on Dewatripont *et al.* (2010).

In this paper, I study the adjustment of banks to the Basel III increased capital requirements. Banks can meet the regulation by changing the asset side (on quantity and/or quality) or by relying on the funding side. More important, I study the characteristics of the bank that leads it to choose among several ways to meet the requirement.

The different contribution of this paper is the use of a larger database (twice the size of the one used by the Bank of International Settlements[29]) and the more detailed split of the contribution in capital and assets towards a target capital ratio. In the asset size, I distinguish volume from quality effects. In the capital side, I use a broader set of capital instruments and adjustments. Finally, I perform statistical tests of significance to check if differences in means are robust. I also perform a multiple linear regression to check results with a different methodology.

I split the adjustment in Capital effect (the numerator) and RWA effect (the denominator). In capital effect, I split further on equity issue, earnings, dividends and some other capital instruments to address the contribution of each item to the full capital

[29] See Cohen & Scatigna (2014)

effect. For the RWA effect, I split among risk classes (credit, market and operational) and between quality and volume effect inside each class (we do not have this disentangled in operational risk).

Not all levers are alike: less total assets are more credible from the outside than reduced risk weights: banks seem to have been very optimistic in the past in evaluating their own risks.

In the preliminary assessment that EBA (2013) reported on the differences between RWA across banks, the conclusion is that 50% of the difference (computed as the gap between the 5% and the 95% percentiles of the global charge - or RWA plus Expected Loss over exposure at default) is explained by type-A factors (mainly the profile of the loan book and the use of standard or IRB approaches) and the remainder to type-B factors (the use of advanced IRB and some other interpretation of the parameters). The database used refers to the largest banking groups in the world, where IRB approaches (standard or advanced) are much more probable[30]. As such, a note of cautions must be made on the usage of internal models. The quality assessment is bank/supervisor specific and risk weights may not mimics the true embedded risk as a result of "window dressing".

This paper shows evidence on several grounds.

Banks target higher ratios than required, pointing to the conclusion that regulation may not be binding of the optimal capital structure (or the needed capital is not observed).

We also conclude that banks increase equity even when they can avoid it; this is particularly evident in the group of banks that starts the analysis period with higher capital

[30] A significant group of banks uses the basic indicator approach to operational risk. However, this risk has a very limited impact on explaining changes in capital ratios.

ratios.

By will or capacity, State owned banks use much less equity increase to meet targets.

Most of the adjustment to higher ratios was done through retained earnings. This conclusion is consistent to the finding of other authors.

European banks have much lower profitability during the period, and so they have to rely on asset side adjustments, mainly containing credit volume and significantly increasing credit quality.

Emerging country banks suffered a lot less from the financial crisis and are able to increase the asset side during the period of analysis. As such, they have to compensate with much more capital build-up than their developed country counterparts.

Size (or even higher requirements of the SIFI group) does not explain bank behavior towards higher capital ratios.

Finally, leverage seems to be weakly correlated with regulatory capital ratios.

These conclusions have important regulatory implications. Size discrimination of the regulation seems to produce meager (if any) effects. Banks target much higher capital ratios than required by regulation. However, there might be a link between higher requirements from Basel III and the capital increase made by the banks. The explanation can be found on the value of flexibility (banks prefer to run above minimum to be able to exploit good asset growing opportunities or to avoid immediate call of funds in the case of losses) or some market friction (like discontinuities in credit rating and conse-

quent funding costs or the access to lower quality / higher margin assets that require higher slack in the capital ratio). Furthermore, we do not observe the exact capital requirement demanded by supervision on SREP (supervisory review and evaluation process); it is possible that supervisors demand more capital under pillar II and so the slack is smaller or non-existent.

Regulation allows banks to play with the relationship between assets and liabilities to meet a given capital target, since the requirement is a ratio. It is fair to say that regulation is not imposing a low risk strategy, as the requirements can be achieved with various combinations of capital and asset profiles.

The remaining of this paper is organized as follows: part 2 presents a literature review, part 3 describes the database and specially discusses the split made on capital and risk weighted assets, part 4 presents the results of the tests and part 5 concludes.

2 Review of the Literature

From the early days of the Basel regulation, some research has been made to find if regulatory minimum levels are binding bank target capital levels. A pioneering research is Shrieves & Dahl (1992) that points to the existence of some other forces that can explain the limitation of risk levels, like ownership preferences or managers private incentives. The same result is found in several other papers like Gropp & Heider (2009) or Schaeck & Cihák (2012).

Cohen & Scatigna (2014) address the issue of what instrument is responsible for the adjustment. Using a database of 94 large global banks, the authors found that the bulk

of the adjustment towards new capital requirements was done with retained earnings (less generous dividends) and much less with reductions in the risk profile of the assets. This conclusion is in line with the more extensive database used in this paper. Curiously enough, they found no reduction on lending, despite a slower growth among European banks. I found the same volume effect (marginally negative, however) but with very significant reduction in the risk weight of loan assets by European banks. The authors also analyze the impact of each extra percentage point of existing capital on the loan portfolio, total assets, total RWA and the trading portfolio. For instance, they found that banks with higher capital ratios in 2009 tend to grow faster their asset base in the period 2009-2012 (they were unconstrained). The relationship to loan or RWA growth is also positive but not significant.

Kok & Schepens (2013) found that banks adjust in an asymmetric fashion to shocks. When banks are overcapitalized, they prefer to adjust by increasing total assets or increasing the riskiness of assets (without reducing equity by paying extra dividends, for instance); whereas when under-capitalized they try to adjust via risk weighted assets or equity issues. These findings are consistent with the conclusions of this paper. The authors also address the reaction to the economic environment. For instance, an under-capitalized bank might issue equity during ”normal” times but has to rely on deleveraging during crisis years, when capital markets may not be available.

Memmel & Raupach (2010) report the adjustment of capital ratios among German banks, using monthly regulatory data. They found the existence of target capital ratios above regulatory minimum, in line to our findings. However, contrary to our conclusions, the authors claim that asset side adjustments are prevalent to meet capital ratio targets.

Francis & Osborne (2012) have an interesting and unique database: they use bank

specific regulation, or the capital adjustments required in the UK for each bank, taking into account governance, risk management and market environment. This approach is interesting as an 8% fixed threshold is not a good proxy for an unconstrained bank (markets and regulators may be imposing higher levels). The study finds that loan growth is positively associated with high target capital level, but not so with required capital level. If a well capitalized bank has better chances of increasing the loan book, this effect does not happen when the bank is still adjusting to the preferred target level. A bank with a low capital target level will have the incentive to comply to the regulation with the lower quality capital accepted, like tier II instruments (I don't back this conclusion using the global database. It seems that lower capital ratio banks use more asset side adjustments and not necessarily low quality capital). A regulatory imposition might lead to this type of behavior; high quality capital should be demanded. However, banks can play with the level of assets or the risk weights.

Camara *et al.* (2013) uses a database of 1142 European banks to investigate the impact of capital regulation on risk profile of banks. The regulation shock studied is Basel I. The authors concluded for the existence of different risk impacts from the instrument (equity, subordinated or hybrid capital) used by banks to fulfill regulation requirements. However, they don't address why banks choose one instrument or some other.

Tanda (2015) has a very comprehensive overview of past literature, mainly addressing the period before Basel III. Her conclusions point to the existence of a significant link between regulation and bank decisions on capital.

3 Data and Summary Statistics

The data-set that I use is compiled from annual reports and pillar 3 disclosures from the largest banks in the world. In this sample, I consider all banks that, in the starting year of 2008, have at least 40 billion US dollars of assets. In total, we have 215 banks, from which we can work with 184. The remaining banks have very little information.

Before using the data, I made some treatment to fill the missing information on some variables. The missing information is the split of risk weighted assets among credit, market and operational risk.

Whenever I have most of the data for a bank, with one or two missing values, I extrapolate the missing values using mainly two ratios: the market risk value over the trading book (or the risk weight used to the trading portfolio) and the operating risk over the RWA. Credit risk is computed as the remainder. The next methodology used to fill the gaps is a recursive regression: I run a regression on the sample of banks with full information to have the coefficients for the missing variables. Then I use the prediction for each missing value and run again the regression to calculate new predictions. I continue to do this until the predictions for the missing values stabilize (my implementation considered the sample to have stabilized when the square of the differences between two consecutive predictions is less than 20% of the previous squared prediction[31]). After 39 iterations, the changes are very small. This method fills missing values for around 20% of the banks.

Using the regressed coefficients, I am neutralizing the effect of those variables. As such, the entire row of information can be used (much richer than just the RWA split) that otherwise would have to be dropped. The RWA split accounts for a small part of

[31] I am summing squares of monetary amounts, which are huge numbers. In the last 10 iterations, the coefficients of the regression changed very little.

the capital adjustment effect studied.

Then I split, for each single bank, the change in Total Capital ratio (measured as Regulatory Capital / Risk Weighted Assets) from 2008 to 2013 into several components. The method used is a chain of ratios that represent a mathematical identity. Capital and RWA effects are split into components, and Credit and Market Risks inside RWA were further split[32]. The meaning of each effect is explained in Apendix 1.

$$\frac{k_1}{RWA_1} - \frac{k_0}{RWA_0} = Capital^E + RWA^E \tag{14}$$

The capital effect is defined like this:

$$Capital^E = \frac{k_1 - k_0}{RWA_1} \tag{15}$$

And the RWA effect is

$$RWA^E = \frac{k_0}{RWA_1} - \frac{k_0}{RWA_0} \tag{16}$$

The capital is further split in its components of equity (share capital plus equity premium), earnings, dividends, other Core Tier 1, other Tier 1, and Tier 2. The denominator is always RWA at the end of the period. Some effects are computed as differences, like equity effect that represents the difference between end period equity and beginning period equity. Earnings and dividends effects are computed as the total amount of each component during the full period, again divided by RWA. To solve the equation, reserves are adjusted accordingly and summed up inside other Core Tier 1 effects.

[32]The subscript 0 represents the beginning of the period of analysis, meaning 2008, and the subscript 1 represents the end of the period, or 2013. I will also used a superscript E to represent the effect. When no superscript is present, the dollar amount is represented.

The RWA effect is decomposed into Credit (CR), Market (MR) and Operational (OR) risk effects. For the sake of illustration, the credit risk effect is computed like this:

$$CR^E = \frac{k_0}{CR_1 + MR_0 + OR_0} - \frac{k_0}{CR_0 + MR_0 + OR_0} \tag{17}$$

With this decomposition, a cross effect must arise and it is disclosed. However, it represents always very small amounts and with no significant difference between sample groups.

In **Table 6**, I present descriptive statistics of the splitting process done. The first conclusion that can taken from the table is the quite robust average capital ratio of the banks included in the sample. The average is unweighted. However, the big standard deviation points to very different situations inside the sample.

During the five year period of the study, banks increased capital ratio in 2.62 percentage points, achieved by an increase in capital, as the risk weighted assets also increased, pressuring the ratio down.

The capital effect is the result of significant retained earnings. Equity increase also plays a relevant role, but less relevant than retained earnings. In terms of quality, the table shows more equity contribution than lower quality capital. During this period, some lower quality capital instruments, issued before the global financial crisis of 2008, were disqualified by Basel III regulation.

It is fair to say that equity holders bear most of the burden of the adjustment, either by bringing more capital to their banks, or by sacrificing dividends, in order to boost retained earnings.

One interesting aspect is the persistence of dividends together with equity calls. Taking only the banks with higher dividends effect (the group below the median of a negative effect of 1,16%), equity effect is almost indistinguishable from the group with lower dividends effects (2.22% against 2.35%, not statistically significant at a 90% confidence level). The pecking order theory predicts dividend persistence, and it seems to be the case here.

In terms of risk weighted assets, all components contribute to an increase in the denominator, requiring more capital. In credit and market risks, volume effect is responsible for the added risk, as the quality, measured here as the risk weight, improved.

Another interesting result is the dispersion around the mean, with credit impacts (volume and quality) showing higher dispersion. As the database covers a period of the recovery from the financial crisis, also earnings effect presents significant dispersion.

Table 6

This table reports the way banks adjust to new capital ratios, from 2008 to 2013. Sample consists of the largest 184 banks in the world, all with total assets in 2008 above USD 40 bn.

	Average	Std Deviation
Initial Capital Ratio	14,00%	10,57%
RWA effect	-1,30%	9,22%
Capital effect	3,92%	7,48%
Final Capital Ratio	16,62%	9,68%
Capital Effects		
Equity effect	2,28%	3,60%
Earnings effect	4,44%	7,80%
Dividends effect	-1,78%	2,15%
Other Core Tier 1 effect	-0,07%	5,80%
Non Core Tier 1 Effect	-0,64%	1,95%
Tier 2 effect	-0,30%	2,25%
RWA Effects		
Credit Risk Effect	-1,08%	8,48%
Market Risk effect	-0,03%	0,65%
Operational Risk effect	-0,33%	1,03%
cross effect	0,13%	0,43%
Credit Risk Effects		
Impairment effect	0,10%	0,38%
Quality effect	1,19%	7,48%
Volume effect	-2,37%	6,67%
Market Risk Effects		
Quality effect	0,05%	0,84%
Volume effect	-0,08%	0,64%
Sample Count	184	

4 Methodology and Empirical Tests

The way banks increase capital ratios is not homogeneous. In this section, I test some banks characteristics that explain different behavior. The methodology used is a split of the dataset around each characteristic, compute the average and test if the difference between the averages is significantly different from zero.

The first test, presented on **Table 7**, splits the sample between State owned and privately owned banks. The ownership characteristic is taken from the database of a previous paper[33].

State owned banks have a smaller increase in capital ratio, but they started with a higher number. It is not statistically significant the impact of the credit volume, but it seems that State owned banks keep granting credit and increasing capital.

It is interesting the reduction of lower quality capital among privately owned banks (compensated by more equity), that had a lot more usage of this type of instruments before Basel III regulation.

In **Table 8** the sample is evenly split in terms of the size of assets (2013 figures). The conclusion is that size is not a significant characteristic to lead banks to different behavior. This result also supports the option not to weight individual figures according to a size characteristic, like total assets, as the outcome would not be affected.

The same exercise is performed using a split between SIFI and non-SIFI banks (**Table 9**). SIFI, meaning *Systemic Important Financial Institution*, is a classification granted by the Bank of International Settlements to banks that have significant impact on the World financial system, due to size, interconnectedness, dispersion of business world-

[33] see Rocha (2013)

wide. I use the final list of November 2014 (the only relevant for the obligation to have more capital). The sample uses prior information, however BIS revealed every year (since 2011) the likely candidates to be SIFI in 2014, and the list did not change very much during the period. I assume SIFI anticipated the classification and behaved accordingly.

SIFI banks have to comply with higher capital ratios, being the difference made by high quality capital. However, the differences in behavior to non-SIFI banks are not significant.

Geography plays a lot more relevant role to explain significant differences among banks. Emerging market banks have almost a negligible increase in capital ratios (see **Table 10**); however, they have significant increases in capital requirements (or RWA) and available capital. Developed market banks reduced capital requirements and increased available capital by a much smaller percentage.

Developed market banks reduced credit and market risk, mainly through volume effect. These banks had also less profitability and, consequently, less dividend distribution.

Developed market behavior is driven mainly by European banks that reached the crisis in a worse shape than counterparts, as in **Table 11** it is possible to see that US banks played an insignificant role on the developed market performance. In **Table 12** we see the full impact of European banks, that represent almost half of the sample. In all tests, only European banks reveal a statistically significant lower initial capital ratio[34]. It is evident the strong reduction of credit risk, mainly driven by an increase in quality. European banks have less profitability to recover capital ratios, and also spend less on dividends. They were also the banks that reduced strongly Tier 2 capital instruments,

[34]Exception made obviously to the last test, where banks are split by their initial capital ratio, and so the significant difference is obtained by construction.

very popular until the crisis.

When I combine US and European banks to compare against all the others (**Table 13**), results are similar to the European effect, just a little more pronounced.

In **Table 14** I split the sample in two according to the growth rate of total assets. By construction, the RWA effect of the fast growth banks is significantly lower than slow growth banks. Interesting is the fact that fast growth banks had much higher profitability and significantly less impairment effects on their credit risk.

One of the novelties from Basel III is the leverage ratio (**Table 15**). I split the sample in two groups according to the leverage ratio of 2008. The first striking result is that the total capital ratio is more or less similar in both sets. This result has significant regulatory implications, as it represents a disturbing conclusion: it is possible to achieve the same regulatory target even with completely different leverage ratios[35]. High leverage banks have a leverage ratio of 31, whereas low leverage stay at 12.

With Basel III rules, the leverage ratio will represent a constraint[36]. As such, the table reveals an adjustment more evident in the amount of the securities portfolio[37], or the volume of market risk.

Another interesting characteristic is the relationship between loans and deposits (see **Table 16**). Banks with more deposits than loans perform better during this period (probably due to significant liquidity constraints in the market), using retained earn-

[35]Blum (2008) address the same concern that "dishonest" banks can report safer risk weighted ratios relatively unnoticed by the supervisor.

[36]In the period of the analysis, the leverage constraint is not yet mandatory. However, banks know that something between 25 and 33 will be the admissible maximum.

[37]The volume effect of market risk is not the dollar value of the securities portfolio, as also off-balance sheet items account for market risk. However, it is used as a proxy to disentangle volume and quality effects.

ings to increase the total capital ratio. However, these ”higher deposits” banks also increased the volume of credit risk (more loans), in sharp contrast to the meager decrease from their ”higher loans” counterparts.

In **Table 17**, I explore the impact of Return on Equity, or ROE. The large dispersion of reduced ROE is caused by the inclusion of loss making and negative equity banks. The difference between initial capital ratios is not being statistically significant, as ROE mainly arises in subsequent years[38]. For the final capital ratio, the test supports the idea that higher ROE is associated with lower capital ratio, in line with a traditional positive relationship between risk and return.

Furthermore, higher ROE banks earned significantly more (by construction) during the analysis period, paying more in dividends (with more retained earnings), and increasing significantly more the loan portfolio.

Another test is performed splitting the sample banks according to the loan growth ratio seen during the period of analysis (**Table 18**). By construction, higher loan growth banks had a much lower capital contribution via credit volume effect. The banks that increase credit more also increase market risk via a volume effect. These banks have higher capital ratio to begin with, and can also extract higher profits from the activity during the period.

My final test splits the banks according to the initial capital ratio (**Table 19**). The median capital ratio, used to split the sample, is 12,3%. Given also the regulatory minimum, it is not surprising the very low dispersion of the lower capital ratio group.

Banks with higher initial capital ratio are able to extract more profitability from the

[38]The split was performed using the average ROE (unweighted) during the period.

activity[39], also increasing the volume of the loan portfolio. In the end, even after a robust safety margin above minimum capital requirements, this group increase the capital ratio even further during the period. However, the lower initial capital ratio group catches up during the period, mainly due to a positive RWA effect (or less balance sheet expansion).

Quite surprising is the contribution of the equity effect on Higher Capital Ratio Banks, undistinguished from the equity effect of their Lower Capital Ratio counterparts. This means that banks that could avoid issuing new equity decided to do it anyhow. The pecking order theory is contradicted by evidence in this real life experiment. The explanation can be found in the credit ratings of the bank that show discontinuities in terms of pricing and quantity. For instance, Central Bank discount window access might be capped at an investment grade level. SREP, or supervisory review and evaluation process, can explain this behavior, as we cannot observe the true capital ratio required by local supervisor to each bank, as part of pillar two reviews.

The table also shows that the dividend impact is very similar, with symmetric sign, to the equity effect: Higher Capital Ratio banks could have foregone equity issues simply by sacrificing dividends. This is consistent with the pecking order theory prediction that firms stick to a stable dividend policy, showing reluctance to change it. This sticky dividend policy is even more evident in the Lower Capital Ratio group that has more capital to build and, even so, distributes most of the earnings.

As a robustness check on the conclusions, a multiple linear regression is performed on major dependent variables, namely the equity and dividend effects on the capital numerator, and the credit volume and quality effects on the RWA denominator. Results are presented on **Table 20**.

[39]This profitability is measured in terms of RWA, a proxy to a Return on Assets ratio. This paper finds lower ROE profitability of higher initial capital ratio banks

As expected, a higher effect on other capital instrument reduces the need for more equity. Bear in mind that dividends have always a negative sign, as they contribute negatively for the capital formation. As such, a negative coefficient means that more dividends (a larger negative number in the dividend effect) call for more equity. Also, more credit risk (a negative effect) calls for more equity[40].

More curious is the coefficient of the initial capital ratio. There is some mild evidence that supports more equity effect from the banks that are already more capitalized.

Emerging country banks and European banks have significant positive coefficients on the dummy variables. For different reasons, both groups call for more capital: emerging country banks to support asset expansion and European banks to recover from weaker capital structures. It is also observable that State owned bank rely less on equity to increase capital ratios.

Not less interesting is the result of the dividend effect regression. As expected, all capital instruments have negative coefficients, confirming that a generous dividend policy calls for some form of recapitalization. What is more relevant is that the initial capital ratio or most of the control variables do not present meaningful coefficients. For instance, higher asset growth is not linked to reduced dividends. SIFI banks are associated with less dividends.

The credit volume effect is associated with the expected coefficient sign on capital instruments: more credit calls for more capital and less dividends. Volume and quality run in opposite directions: when volume grows, the risk weight tends to reduce to contain the expansion of the credit risk. Credit volume is also associated with more

[40]The operational risk effect is of less relevancy here. RWA on average is split between credit risk with 88% of the total, market risk with 5% and operational risk with the remaining 7%.

market risk[41]: when the bank is able to expand credit, it is expanding also the securities portfolio. Consistent with previous tests, Emerging country banks are expanding credit volume whereas European banks are shrinking the loan book. The same conclusions can be taken from the final regression on credit quality effect.

5 Conclusions

Based of the 184 largest banking groups in the world, I use the five year period after the global financial crisis (2008-2013) to observe how banks comply with the emerging regulation of Basel III.

Banks target higher ratios than required, pointing to the conclusion that regulation may not be binding of the optimal capital structure. More interesting, banks increase equity even when they can avoid doing it, which seems to contradict the pecking order theory. This is particularly evident in the group of banks that started the analysis period with higher capital ratios.

Most of the adjustment to higher ratios is done through retained earnings. Despite some interaction with the asset side, only groups of banks with lower initial ratios or reduced profitability, namely European banks, use that interdependence to meet ratios (banks with slack in terms of capital or profitability increased assets further).

Size (or even higher requirements of the SIFI group) does not explain bank behavior towards higher capital ratios. Leverage seems to be weakly correlated with regulatory

[41] Bank reporting is sometimes incomplete, with no distinction between trading and banking book. Furthermore, some risks like currency, commodities and settlement on the banking book are considered for market risk. For consistency, I use both trading and banking book for market risk volume effect, and the banking book is removed from credit risk volume effect.

capital ratios.

These conclusions have important regulatory implications. Size discrimination of the regulation seems to produce meager (if any) effects. Banks target much higher capital ratios than required by regulation. However, there might be a link between higher requirements from Basel III and the capital increase made by the banks. The explanation can be found on the value of flexibility (banks prefer to run above minimum to be able to exploit good asset growing opportunities or to avoid immediate call of funds in the case of losses) or some market friction (like discontinuities in credit rating and consequent funding costs or the access to lower quality / higher margin assets that require higher slack in the capital ratio).

It is also evident the correlation between assets and liabilities to meet a given capital target. Regulation allows banks to play with the relationship, since the requirement is a ratio. It is fair to say that regulation is not imposing a low risk strategy, as the requirements can be achieved with various combinations of capital and risk profiles.

6 Tables

Table 7

This table reports the way banks adjusted to new capital ratios, from 2008 to 2013. Sample consists of the largest 184 banks in the world, all with total assets in 2008 above USD 40 bn. The sample is split between State owned and privately owned banks. A bank is considered State owned if the main shareholder is the Government of the country where the bank is incorporated.
T-stat and last column refer to a two-sided test of difference in means, being H0 the hypothesis that the population means are equal, against the alternative H1 that the difference between population means is different from zero. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	State Owned		Privately Owned			
Variable	mean	stdev	mean	stdev	t-stat	
Initial Capital Ratio	14,40%	12,32%	13,87%	10,01%	0,195	
RWA effect	-3,44%	10,58%	-0,63%	8,69%	-1,205	
Capital effect	5,19%	5,87%	3,53%	7,89%	1,071	
Final Capital Ratio	16,16%	7,62%	16,77%	10,26%	-0,305	
Equity effect	1,03%	2,28%	2,68%	3,84%	-2,462	**
Earnings effect	4,92%	7,28%	4,29%	7,98%	0,357	
Dividends effect	-1,51%	1,41%	-1,87%	2,33%	0,869	
Other Core Tier 1 effect	0,44%	4,96%	-0,23%	6,05%	0,535	
Non Core Tier 1 Effect	-0,03%	0,95%	-0,83%	2,14%	2,446	**
Tier 2 effect	0,35%	1,92%	-0,50%	2,32%	1,756	*
Credit Risk Effect	-3,26%	10,20%	-0,39%	7,78%	-1,307	
Market Risk effect	-0,11%	0,73%	0,00%	0,63%	-0,627	
Operational Risk effect	-0,30%	0,82%	-0,34%	1,09%	0,142	
cross effect	0,23%	0,46%	0,10%	0,42%	1,299	
Impairment effect	0,11%	0,38%	0,10%	0,38%	0,102	
CR Quality effect	1,02%	12,69%	1,25%	4,87%	-0,098	
CR Volume effect	-4,39%	9,74%	-1,73%	5,25%	-1,386	
MR Quality effect	-0,04%	0,66%	0,08%	0,88%	-0,688	
MR Volume effect	-0,06%	0,63%	-0,08%	0,65%	0,118	
Sample Count	44		140			

Table 8

This table reports the way banks adjusted to new capital ratios, from 2008 to 2013. Sample consists of the largest 184 banks in the world, all with total assets in 2008 above USD 40 bn. The sample is split evenly using 2013 total assets in USD terms (larger banks have more than USD 203,5 bn. in assets). T-stat and last column refer to a two-sided test of difference in means, being H0 the hypothesis that the population means are equal, against the alternative H1 that the difference between population means is different from zero. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	Larger		Smaller			
Variable	mean	stdev	mean	stdev	t-stat	
Initial Capital Ratio	15,28%	14,62%	12,72%	2,80%	1,412	
RWA effect	-2,22%	10,87%	-0,38%	7,16%	-0,977	
Capital effect	4,92%	8,74%	2,93%	5,82%	1,312	
Final Capital Ratio	17,98%	13,01%	15,26%	3,92%	1,540	
Equity effect	2,16%	2,68%	2,40%	4,33%	-0,330	
Earnings effect	5,61%	5,68%	3,26%	9,35%	1,498	
Dividends effect	-1,86%	1,87%	-1,70%	2,40%	-0,362	
Other Core Tier 1 effect	-0,11%	6,30%	-0,03%	5,30%	-0,066	
Non Core Tier 1 Effect	-0,61%	2,03%	-0,67%	1,88%	0,140	
Tier 2 effect	-0,27%	2,46%	-0,34%	2,04%	0,151	
Credit Risk Effect	-1,97%	10,03%	-0,19%	6,51%	-1,031	
Market Risk effect	-0,02%	0,75%	-0,04%	0,54%	0,148	
Operational Risk effect	-0,34%	1,28%	-0,32%	0,69%	-0,073	
cross effect	0,10%	0,48%	0,16%	0,37%	-0,732	
Impairment effect	0,05%	0,26%	0,14%	0,46%	-1,202	
CR Quality effect	0,98%	8,34%	1,40%	6,54%	-0,269	
CR Volume effect	-3,00%	5,33%	-1,73%	7,77%	-0,930	
MR Quality effect	0,03%	1,00%	0,07%	0,63%	-0,267	
MR Volume effect	-0,04%	0,79%	-0,11%	0,46%	0,504	
Sample Count	92		92			

Table 9

This table reports the way banks adjusted to new capital ratios, from 2008 to 2013. Sample consists of the largest 184 banks in the world, all with total assets in 2008 above USD 40 bn. The sample is split between SIFI and non-SIFI banks, according to the BIS disclosure in November 2014.
T-stat and last column refer to a two-sided test of difference in means, being H0 the hypothesis that the population means are equal, against the alternative H1 that the difference between population means is different from zero. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	SIFI		Non-SIFI			
Variable	mean	stdev	mean	stdev	t-stat	
Initial Capital Ratio	14,23%	4,04%	13,96%	11,33%	0,157	
RWA effect	-0,67%	4,16%	-1,41%	9,84%	0,468	
Capital effect	3,19%	3,85%	4,05%	7,94%	-0,629	
Final Capital Ratio	16,75%	3,29%	16,60%	10,40%	0,097	
Equity effect	2,73%	2,95%	2,21%	3,70%	0,608	
Earnings effect	5,49%	3,53%	4,26%	8,31%	0,922	
Dividends effect	-1,55%	1,15%	-1,82%	2,28%	0,690	
Other Core Tier 1 effect	-0,87%	3,18%	0,06%	6,14%	-0,844	
Non Core Tier 1 Effect	-1,68%	2,95%	-0,46%	1,67%	-1,735	*
Tier 2 effect	-0,95%	1,88%	-0,19%	2,30%	-1,390	
Credit Risk Effect	-0,39%	3,92%	-1,20%	9,04%	0,547	
Market Risk effect	-0,19%	0,63%	0,00%	0,66%	-1,088	
Operational Risk effect	-0,11%	0,97%	-0,37%	1,04%	0,949	
cross effect	0,02%	0,28%	0,15%	0,45%	-1,473	
Impairment effect	-0,01%	0,14%	0,12%	0,40%	-2,139	**
CR Quality effect	1,49%	2,40%	1,14%	8,04%	0,314	
CR Volume effect	-1,87%	4,03%	-2,46%	7,03%	0,441	
MR Quality effect	-0,36%	0,52%	0,12%	0,86%	-2,828	***
MR Volume effect	0,17%	0,66%	-0,12%	0,63%	1,628	
Sample Count	27		157			

Table 10

This table reports the way banks adjusted to new capital ratios, from 2008 to 2013. Sample consists of the largest 184 banks in the world, all with total assets in 2008 above USD 40 bn. The sample is split between banks incorporated in Emerging Markets (IMF country classification) and banks incorporated in Developed markets.

T-stat and last column refer to a two-sided test of difference in means, being H0 the hypothesis that the population means are equal, against the alternative H1 that the difference between population means is different from zero. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	Emerging		Developed			
Variable	mean	stdev	mean	stdev	t-stat	
Initial Capital Ratio	15,35%	17,03%	13,56%	7,42%	0,563	
RWA effect	-8,95%	11,06%	1,18%	6,97%	-4,523	***
Capital effect	9,58%	10,72%	2,09%	4,87%	3,722	***
Final Capital Ratio	15,97%	17,22%	16,83%	5,43%	-0,285	
Equity effect	3,61%	5,18%	1,85%	2,80%	1,745	*
Earnings effect	7,24%	11,07%	3,53%	6,18%	1,704	*
Dividends effect	-2,54%	2,12%	-1,54%	2,11%	-2,012	**
Other Core Tier 1 effect	0,23%	8,48%	-0,17%	4,66%	0,240	
Non Core Tier 1 Effect	-0,02%	0,81%	-0,84%	2,16%	2,703	***
Tier 2 effect	1,05%	1,51%	-0,74%	2,28%	4,269	***
Credit Risk Effect	-8,12%	9,88%	1,20%	6,54%	-4,598	***
Market Risk effect	-0,28%	0,62%	0,06%	0,64%	-2,307	**
Operational Risk effect	-0,84%	1,57%	-0,16%	0,71%	-2,324	**
cross effect	0,30%	0,44%	0,08%	0,41%	2,179	**
Impairment effect	0,09%	0,36%	0,10%	0,38%	-0,095	
CR Quality effect	-1,41%	6,79%	2,04%	7,52%	-2,089	**
CR Volume effect	-6,80%	4,76%	-0,93%	6,58%	-4,630	***
MR Quality effect	0,03%	0,71%	0,05%	0,87%	-0,151	
MR Volume effect	-0,31%	0,53%	0,00%	0,66%	-2,312	**
Sample Count	45		139			

Table 11

This table reports the way banks adjusted to new capital ratios, from 2008 to 2013. Sample consists of the largest 184 banks in the world, all with total assets in 2008 above USD 40 bn. The sample is split between banks incorporated in the US and banks incorporated in any other country.
T-stat and last column refer to a two-sided test of difference in means, being H0 the hypothesis that the population means are equal, against the alternative H1 that the difference between population means is different from zero. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	US		Non-US			
Variable	mean	stdev	mean	stdev	t-stat	
Initial Capital Ratio	15,97%	3,90%	13,72%	11,19%	1,331	
RWA effect	-1,32%	5,42%	-1,30%	9,66%	-0,012	
Capital effect	1,69%	5,79%	4,24%	7,65%	-1,409	
Final Capital Ratio	16,35%	3,73%	16,66%	10,26%	-0,200	
Equity effect	3,18%	3,59%	2,16%	3,59%	0,994	
Earnings effect	5,56%	3,93%	4,28%	8,20%	0,876	
Dividends effect	-1,53%	1,62%	-1,82%	2,22%	0,564	
Other Core Tier 1 effect	-1,12%	3,80%	0,08%	6,03%	-0,943	
Non Core Tier 1 Effect	-3,32%	3,11%	-0,26%	1,36%	-4,049	***
Tier 2 effect	-1,08%	1,90%	-0,19%	2,28%	-1,548	
Credit Risk Effect	-1,15%	4,79%	-1,07%	8,89%	-0,047	
Market Risk effect	-0,26%	0,68%	0,01%	0,65%	-1,402	
Operational Risk effect	-0,02%	1,08%	-0,37%	1,01%	1,166	
cross effect	0,10%	0,46%	0,13%	0,43%	-0,232	
Impairment effect	-0,07%	0,12%	0,12%	0,39%	-3,344	***
CR Quality effect	0,12%	3,15%	1,35%	7,90%	-0,955	
CR Volume effect	-1,20%	5,51%	-2,54%	6,82%	0,790	
MR Quality effect	-0,06%	0,40%	0,06%	0,88%	-0,824	
MR Volume effect	-0,20%	0,71%	-0,06%	0,63%	-0,721	
Sample Count	23		161			

Table 12

This table reports way banks adjusted to new capital ratios, from 2008 to 2013. Sample consists of the largest 184 banks in the world, all with total assets in 2008 above USD 40 bn. The sample is split between banks incorporated in Europe and banks incorporated in any other continent.
T-stat and last column refer to a two-sided test of difference in means, being H0 the hypothesis that the population means are equal, against the alternative H1 that the difference between population means is different from zero. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	European		Non-European			
Variable	mean	stdev	mean	stdev	t-stat	
Initial Capital Ratio	12,24%	2,66%	15,35%	13,74%	-1,893	*
RWA effect	3,77%	5,67%	-5,20%	9,55%	5,715	***
Capital effect	1,10%	4,80%	6,10%	8,41%	-3,675	***
Final Capital Ratio	17,11%	4,11%	16,25%	12,38%	0,512	
Equity effect	2,39%	4,44%	2,21%	2,80%	0,233	
Earnings effect	0,28%	8,66%	7,64%	5,18%	-4,983	***
Dividends effect	-1,00%	1,32%	-2,39%	2,45%	3,569	***
Other Core Tier 1 effect	1,17%	6,00%	-1,03%	5,49%	1,825	*
Non Core Tier 1 Effect	-0,53%	1,59%	-0,72%	2,19%	0,497	
Tier 2 effect	-1,21%	2,11%	0,40%	2,11%	-3,637	***
Credit Risk Effect	3,55%	5,08%	-4,64%	8,86%	5,698	***
Market Risk effect	0,22%	0,58%	-0,22%	0,65%	3,402	***
Operational Risk effect	-0,12%	0,58%	-0,49%	1,25%	1,953	*
cross effect	0,12%	0,32%	0,14%	0,50%	-0,171	
Impairment effect	0,27%	0,49%	-0,03%	0,15%	4,363	***
CR Quality effect	3,30%	6,75%	-0,42%	7,63%	2,475	**
CR Volume effect	-0,02%	7,60%	-4,18%	5,21%	3,055	***
MR Quality effect	0,06%	0,62%	0,04%	0,97%	0,136	
MR Volume effect	0,16%	0,48%	-0,26%	0,70%	3,390	***
Sample Count	80		104			

Table 13

This table reports the way banks adjusted to new capital ratios, from 2008 to 2013. Sample consists of the largest 184 banks in the world, all with total assets in 2008 above USD 40 bn. The sample is split between banks incorporated in the US or Europe and banks incorporated in any other country.
T-stat and last column refer to a two-sided test of difference in means, being H0 the hypothesis that the population means are equal, against the alternative H1 that the difference between population means is different from zero. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	Non US/European		US or European			
Variable	mean	stdev	mean	stdev	t-stat	
Initial Capital Ratio	15,18%	15,46%	13,07%	3,35%	1,028	
RWA effect	-6,30%	10,19%	2,63%	5,98%	-5,194	***
Capital effect	7,35%	8,64%	1,23%	5,01%	4,209	***
Final Capital Ratio	16,22%	13,91%	16,94%	4,03%	-0,368	
Equity effect	1,93%	2,49%	2,56%	4,26%	-0,911	
Earnings effect	8,22%	5,35%	1,46%	8,14%	4,841	***
Dividends effect	-2,63%	2,60%	-1,12%	1,40%	-3,537	***
Other Core Tier 1 effect	-1,01%	5,90%	0,66%	5,65%	-1,377	
Non Core Tier 1 Effect	0,01%	1,02%	-1,15%	2,33%	3,402	***
Tier 2 effect	0,82%	1,99%	-1,18%	2,06%	4,728	***
Credit Risk Effect	-5,63%	9,51%	2,50%	5,36%	-5,129	***
Market Risk effect	-0,20%	0,65%	0,11%	0,63%	-2,355	**
Operational Risk effect	-0,62%	1,27%	-0,10%	0,72%	-2,474	**
cross effect	0,15%	0,51%	0,12%	0,35%	0,304	
Impairment effect	-0,02%	0,16%	0,20%	0,46%	-3,505	***
CR Quality effect	-0,58%	8,50%	2,59%	6,26%	-2,030	**
CR Volume effect	-5,02%	4,83%	-0,28%	7,18%	-3,808	***
MR Quality effect	0,07%	1,08%	0,03%	0,58%	0,191	
MR Volume effect	-0,27%	0,70%	0,08%	0,56%	-2,641	***
Sample Count	81		103			

Table 14

This table reports the way banks adjusted to new capital ratios, from 2008 to 2013. Sample consists of the largest 184 banks in the world, all with total assets in 2008 above USD 40 bn. The sample is split evenly using the rate of total assets growth between 2008 and 2013. Assets were computed in USD terms. Fast growth banks grew more than 16.4% during the period, or 3.1% compounded per year.
T-stat and last column refer to a two-sided test of difference in means, being H0 the hypothesis that the population means are equal, against the alternative H1 that the difference between population means is different from zero. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	Fast Growth		Slow Growth			
Variable	mean	stdev	mean	stdev	t-stat	
Initial Capital Ratio	14,40%	12,12%	13,60%	8,81%	0,369	
RWA effect	-5,76%	8,79%	3,16%	7,33%	-5,307	***
Capital effect	7,24%	8,42%	0,61%	4,38%	4,966	***
Final Capital Ratio	15,88%	12,22%	17,36%	6,17%	-0,772	
Equity effect	2,73%	3,20%	1,84%	3,92%	1,207	
Earnings effect	7,65%	5,91%	1,23%	8,16%	4,380	***
Dividends effect	-2,44%	2,47%	-1,13%	1,52%	-3,155	***
Other Core Tier 1 effect	-1,11%	5,80%	0,96%	5,65%	-1,733	*
Non Core Tier 1 Effect	-0,17%	1,32%	-1,11%	2,34%	2,445	**
Tier 2 effect	0,58%	1,94%	-1,18%	2,21%	4,066	***
Credit Risk Effect	-5,06%	7,92%	2,90%	7,06%	-5,095	***
Market Risk effect	-0,22%	0,74%	0,17%	0,48%	-3,074	***
Operational Risk effect	-0,65%	1,26%	-0,01%	0,58%	-3,349	***
cross effect	0,17%	0,52%	0,09%	0,31%	0,868	
Impairment effect	0,02%	0,24%	0,18%	0,46%	-2,086	**
CR Quality effect	0,55%	5,47%	1,83%	9,04%	-0,845	
CR Volume effect	-5,63%	4,16%	0,89%	7,12%	-5,550	***
MR Quality effect	0,12%	1,07%	-0,03%	0,50%	0,928	
MR Volume effect	-0,35%	0,70%	0,20%	0,44%	-4,576	***
Sample Count	92		92			

Table 15

This table reports the way banks adjusted to new capital ratios, from 2008 to 2013. Sample consists of the largest 184 banks in the world, all with total assets in 2008 above USD 40 bn. The sample is split evenly using the leverage ratio (total assets over total equity) in 2008. Higher leverage banks had a ratio above 16.93.

T-stat and last column refer to a two-sided test of difference in means, being H0 the hypothesis that the population means are equal, against the alternative H1 that the difference between population means is different from zero. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	Higher Leverage		Lower Leverage			
Variable	mean	stdev	mean	stdev	t-stat	
Initial Capital Ratio	14,02%	14,66%	13,98%	3,16%	0,021	
RWA effect	0,34%	11,13%	-2,94%	6,47%	1,791	*
Capital effect	3,26%	9,05%	4,59%	5,45%	-0,881	
Final Capital Ratio	17,62%	13,22%	15,63%	3,43%	1,148	
Equity effect	2,03%	2,96%	2,54%	4,14%	-0,695	
Earnings effect	3,09%	6,89%	5,78%	8,44%	-1,684	*
Dividends effect	-1,44%	1,83%	-2,13%	2,38%	1,576	
Other Core Tier 1 effect	0,49%	6,19%	-0,64%	5,36%	0,934	
Non Core Tier 1 Effect	-0,25%	1,55%	-1,03%	2,22%	1,997	**
Tier 2 effect	-0,67%	2,24%	0,06%	2,22%	-1,569	
Credit Risk Effect	0,35%	10,31%	-2,50%	5,84%	1,694	*
Market Risk effect	0,14%	0,51%	-0,20%	0,74%	2,628	***
Operational Risk effect	-0,29%	1,19%	-0,37%	0,83%	0,366	
cross effect	0,14%	0,34%	0,12%	0,50%	0,141	
Impairment effect	0,17%	0,45%	0,03%	0,27%	1,770	*
CR Quality effect	1,57%	10,21%	0,81%	2,81%	0,558	
CR Volume effect	-1,39%	7,55%	-3,35%	5,53%	1,440	
MR Quality effect	0,01%	0,48%	0,09%	1,08%	-0,457	
MR Volume effect	0,13%	0,42%	-0,28%	0,76%	3,397	***
Sample Count	92		92			

Table 16

This table reports the way banks adjusted to new capital ratios, from 2008 to 2013. Sample consists of the largest 184 banks in the world, all with total assets in 2008 above USD 40 bn. The sample is split between banks where customer loans exceed customer deposits and banks where customer deposits surpass customer loans. The indicator is computed as a ratio of loans over deposits, less 1. Higher Loans banks have a positive indicator, whereas Higher Deposits banks have a negative indicator.
T-stat and last column refer to a two-sided test of difference in means, being H0 the hypothesis that the population means are equal, against the alternative H1 that the difference between population means is different from zero. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	Higher Loans		Higher Deposits			
Variable	mean	stdev	mean	stdev	t-stat	
Initial Capital Ratio	13,58%	12,39%	14,38%	8,62%	-0,364	
RWA effect	1,81%	10,13%	-4,15%	7,26%	3,276	***
Capital effect	2,11%	9,10%	5,59%	5,10%	-2,335	**
Final Capital Ratio	17,50%	12,48%	15,82%	6,04%	0,866	
Equity effect	2,48%	4,36%	2,11%	2,72%	0,498	
Earnings effect	1,27%	8,95%	7,34%	5,11%	-4,111	***
Dividends effect	-1,40%	1,97%	-2,13%	2,26%	1,650	*
Other Core Tier 1 effect	1,33%	7,41%	-1,36%	3,33%	2,377	**
Non Core Tier 1 Effect	-0,41%	1,60%	-0,85%	2,21%	1,125	
Tier 2 effect	-1,16%	2,12%	0,48%	2,09%	-3,741	***
Credit Risk Effect	1,79%	9,01%	-3,70%	7,04%	3,273	***
Market Risk effect	0,14%	0,59%	-0,19%	0,67%	2,508	**
Operational Risk effect	-0,25%	1,21%	-0,40%	0,83%	0,715	
cross effect	0,12%	0,48%	0,14%	0,38%	-0,133	
Impairment effect	0,26%	0,47%	-0,05%	0,15%	4,617	***
CR Quality effect	1,51%	5,76%	0,90%	8,78%	0,402	
CR Volume effect	0,02%	5,51%	-4,56%	6,91%	3,545	***
MR Quality effect	0,16%	0,96%	-0,05%	0,69%	1,212	
MR Volume effect	-0,01%	0,74%	-0,13%	0,54%	0,901	
Sample Count	88		96			

Table 17

This table reports the way banks adjusted to new capital ratios, from 2008 to 2013. Sample consists of the largest 184 banks in the world, all with total assets in 2008 above USD 40 bn. The sample is split evenly using the average ROE ratio during the period (unweighted). Higher ROE banks had a ratio above 6.88%.

T-stat and last column refer to a two-sided test of difference in means, being H0 the hypothesis that the population means are equal, against the alternative H1 that the difference between population means is different from zero. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	Higher ROE		Lower ROE			
Variable	mean	stdev	mean	stdev	t-stat	
Initial Capital Ratio	12,85%	2,47%	15,15%	14,70%	-1,282	
RWA effect	-4,27%	6,29%	1,67%	10,66%	-3,364	***
Capital effect	6,18%	4,77%	1,67%	8,91%	3,158	***
Final Capital Ratio	14,76%	2,92%	18,49%	13,15%	-2,231	**
Equity effect	2,32%	3,58%	2,25%	3,63%	0,092	
Earnings effect	7,35%	8,07%	1,52%	6,32%	3,884	***
Dividends effect	-2,75%	2,40%	-0,82%	1,29%	-5,017	***
Other Core Tier 1 effect	-0,94%	4,90%	0,80%	6,49%	-1,465	
Non Core Tier 1 Effect	-0,16%	1,16%	-1,11%	2,42%	2,543	**
Tier 2 effect	0,36%	2,00%	-0,96%	2,31%	2,945	***
Credit Risk Effect	-3,70%	5,81%	1,55%	9,85%	-3,213	***
Market Risk effect	-0,22%	0,61%	0,17%	0,64%	-2,954	***
Operational Risk effect	-0,54%	0,63%	-0,11%	1,28%	-2,176	**
cross effect	0,19%	0,37%	0,07%	0,48%	1,327	
Impairment effect	0,02%	0,24%	0,18%	0,46%	-2,109	**
CR Quality effect	0,94%	2,89%	1,45%	10,19%	-0,378	
CR Volume effect	-4,66%	4,61%	-0,08%	7,60%	-3,594	***
MR Quality effect	-0,01%	0,68%	0,11%	0,97%	-0,678	
MR Volume effect	-0,21%	0,53%	0,06%	0,72%	-2,071	**
Sample Count	92		92			

Table 18

This table reports the way banks adjusted to new capital ratios, from 2008 to 2013. Sample consists of the largest 184 banks in the world, all with total assets in 2008 above USD 40 bn. The sample is split evenly using the rate of gross loan growth between 2008 and 2013. Total loans were computed in USD terms. Fast loan growth banks grew more than 13.9% during the period, or 2.64% compounded per year. T-stat and last column refer to a two-sided test of difference in means, being H0 the hypothesis that the population means are equal, against the alternative H1 that the difference between population means is different from zero. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	Higher Loan Growth		Lower Loan Growth			
Variable	mean	stdev	mean	stdev	t-stat	
Initial Capital Ratio	14,55%	12,12%	13,45%	8,79%	0,503	
RWA effect	-5,61%	8,95%	3,01%	7,31%	-5,089	***
Capital effect	7,20%	8,48%	0,65%	4,33%	4,908	***
Final Capital Ratio	16,14%	12,25%	17,11%	6,15%	-0,507	
Equity effect	2,72%	3,16%	1,84%	3,95%	1,190	
Earnings effect	7,67%	5,64%	1,21%	8,33%	4,434	***
Dividends effect	-2,43%	2,06%	-1,13%	2,05%	-3,037	***
Other Core Tier 1 effect	-1,05%	5,77%	0,90%	5,70%	-1,631	
Non Core Tier 1 Effect	-0,14%	1,29%	-1,14%	2,34%	2,657	***
Tier 2 effect	0,43%	2,10%	-1,03%	2,17%	3,269	***
Credit Risk Effect	-4,95%	8,08%	2,79%	7,00%	-4,923	***
Market Risk effect	-0,23%	0,74%	0,17%	0,49%	-3,087	***
Operational Risk effect	-0,62%	1,28%	-0,04%	0,55%	-3,059	***
cross effect	0,18%	0,53%	0,08%	0,30%	1,111	
Impairment effect	0,02%	0,23%	0,18%	0,47%	-2,091	**
CR Quality effect	1,00%	5,65%	1,39%	8,97%	-0,252	
CR Volume effect	-5,97%	3,86%	1,23%	6,96%	-6,390	***
MR Quality effect	0,07%	1,09%	0,03%	0,46%	0,243	
MR Volume effect	-0,29%	0,74%	0,14%	0,45%	-3,524	***
Sample Count	92		92			

Table 19

This table reports the way banks adjusted to new capital ratios, from 2008 to 2013. Sample consists of the largest 184 banks in the world, all with total assets in 2008 above USD 40 bn. The sample is split evenly using the total capital ratio in 2008. Higher 2008 Capital Ratio banks had a ratio above 12.35%. T-stat and last column refer to a two-sided test of difference in means, being H0 the hypothesis that the population means are equal, against the alternative H1 that the difference between population means is different from zero. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	Higher 08 Cap Ratio		Lower 08 Cap Ratio			
Variable	mean	stdev	mean	stdev	t-stat	
Initial Capital Ratio	17,31%	14,20%	10,69%	0,96%	4,191	***
RWA effect	-3,59%	10,97%	0,99%	6,34%	-2,542	**
Capital effect	5,08%	9,51%	2,77%	4,38%	1,589	
Final Capital Ratio	18,79%	12,96%	14,45%	3,29%	2,562	**
Equity effect	2,27%	3,26%	2,29%	3,92%	-0,027	
Earnings effect	6,94%	6,41%	1,94%	8,28%	3,264	***
Dividends effect	-2,22%	2,51%	-1,34%	1,61%	-2,050	**
Other Core Tier 1 effect	-0,84%	6,08%	0,69%	5,43%	-1,270	
Non Core Tier 1 Effect	-0,91%	2,37%	-0,36%	1,37%	-1,407	
Tier 2 effect	-0,16%	2,61%	-0,44%	1,83%	0,598	
Credit Risk Effect	-3,15%	10,11%	0,99%	5,80%	-2,497	**
Market Risk effect	-0,11%	0,80%	0,06%	0,46%	-1,284	
Operational Risk effect	-0,45%	1,38%	-0,20%	0,43%	-1,343	
cross effect	0,12%	0,54%	0,14%	0,27%	-0,248	
Impairment effect	0,03%	0,31%	0,17%	0,42%	-1,920	*
CR Quality effect	0,53%	10,19%	1,86%	2,78%	-0,983	
CR Volume effect	-3,70%	7,93%	-1,03%	4,80%	-2,010	**
MR Quality effect	0,03%	1,10%	0,07%	0,43%	-0,275	
MR Volume effect	-0,14%	0,85%	-0,01%	0,31%	-1,023	
Sample Count	92		92			

Table 20

This table reports the way banks adjusted to new capital ratios, from 2008 to 2013. Sample consists of the largest 184 banks in the world, all with total assets in 2008 above USD 40 bn. Multiple linear regression is performed on 4 different dependent variables. All variables have the meaning presented in Appendix 1. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

Dependent variable	Equity Effect			Dividend Effect			Credit Volume Effect			Credit Quality Effect		
Independent variables	Estimate	Std. Error		Estimate	Std. Error		Estimate	Std. Error		Estimate	Std. Error	
(Intercept)	-0,0037	0,0208		0,0074	0,0145		0,0765	0,0293	***	0,1065	0,0330	***
Credit Risk Effect	-0,2210	0,0536	***	-0,0840	0,0388	**						
Credit Quality Effect							-0,7156	0,0400	***			
Credit Volume Effect										-0,9246	0,0516	***
Market Risk Effect	-0,1983	0,2584		0,3003	0,1795	*	1,2930	0,3605	***	0,9926	0,4185	**
Operational Risk Effect	-2,0080	0,2090	***	-0,7052	0,1744	***	-0,5887	0,3758		-1,2836	0,4186	***
Initial Capital Ratio	0,0565	0,0318	*	0,0250	0,0223		-0,1869	0,0355	***	-0,3381	0,0347	***
Equity Effect				-0,3411	0,0478	***	-0,7225	0,1000	***	-0,6914	0,1188	***
Earnings Effect	-0,6521	0,0396	***	-0,3901	0,0333	***	-0,7018	0,0782	***	-0,6392	0,0964	***
Dividends Effect	-0,6974	0,0978	***				-0,7859	0,1514	***	-0,6098	0,1795	***
Other Core T1 Effect	-0,5737	0,0403	***	-0,2595	0,0370	***	-0,4718	0,0797	***	-0,4970	0,0920	***
Non Core T1 Effect	-0,4422	0,0972	***	-0,2516	0,0694	***	-0,6661	0,1394	***	-0,6907	0,1602	***
Tier 2 Effect	-0,2180	0,0780	***	-0,0233	0,0558		-0,3905	0,1102	***	-0,4597	0,1249	***
Asset Growth	0,0081	0,0070		0,0038	0,0049							
Average Leverage	0,0001	0,0001		0,0000	0,0001		0,0002	0,0001		0,0002	0,0002	
Average Loan To Deposits Gap	0,0000	0,0002		-0,0001	0,0001		0,0002	0,0003		0,0002	0,0003	
Average ROE	0,0032	0,0026		-0,0021	0,0019		-0,0020	0,0038		0,0009	0,0044	
Gross Loan Growth	0,0015	0,0064		0,0051	0,0045							
Emerging Dummy	0,0143	0,0050	***	-0,0004	0,0036		-0,0224	0,0071	***	-0,0303	0,0079	***
European Dummy	0,0114	0,0043	***	0,0050	0,0031		0,0137	0,0062	**	0,0193	0,0070	***
US Bank Dummy	0,0106	0,0062	*	0,0057	0,0043		0,0020	0,0089		0,0017	0,0102	
SIFI Dummy	0,0077	0,0058		0,0094	0,0040	**	0,0126	0,0080		0,0122	0,0092	
State Control Dummy	-0,0116	0,0039	***	0,0024	0,0028		-0,0084	0,0057		-0,0035	0,0066	
log of Assets (2013 in USD)	0,0007	0,0017		-0,0013	0,0012		-0,0036	0,0024		-0,0043	0,0027	
Multiple R-squared:	0,7434			0,6485			0,8444			0,8399		
Adjusted R-squared:	0,7120			0,6054			0,8263			0,8213		
F-statistic:	23,62			15,04			46,83			45,28		
Degrees of Freedom:	163			163			164			164		

7 Appendices

Capital Ratio Effects

Effect	Description
Capital Effects	It is the **numerator** effect of the ratio. It represents the change in the amount of regulatory capital.
Equity effect	The change in capital ratio due to the increase or decrease of equity, usually through the floating of new shares. A positive value means a capital increase. Negative values are associated with share buybacks.
Earnings effect	The change in capital ratio due to the earnings of the year. A positive value means the bank had profits.
Dividends effect	he change in capital ratio due to the distribution of dividends. The effect is always negative, as it represents a reduction of equity.
Other Core Tier 1 effect	The change in capital ratio due to changes in reserves or adjustments, like minority interests, goodwill or deferred tax assets.
Non Core Tier 1 Effect	The change in capital ratio due to the increase or decrease of non-Core Tier 1 instruments, like non-cumulative preferred shares. A positive value means the floating of new instruments.
Tier 2 effect	The change in capital ratio due to the increase or decrease of Tier 2 instruments, like subordinated loans. A positive value means the floating of new instruments.
RWA Effects	It is the **denominator** effect of the ratio. A lower RWA will help banks to fulfil capital requirements.
Credit Risk Effect	It is the change in the total amount of credit risk weighted by the correspondent risk weight. A positive number means more credit risk, which can surge by added quantity (a volume effect), lower quality (increase in the average risk weight) or lower impairment (as an increase in impairment reduces the net volume of credit risk, for the same volume of gross credit)
Market Risk effect	It is the change in the total amount of market risk, measured as the capital requirement for this type of risk multiplied by 12.5. A positive number means more market risk, which can result from an increase in the market portfolio (a volume effect) or from lower quality (increase in the average risk weight). In almost all banks in the database, there is no disclosure of the split of Market Risk capital requirements between trading and banking book. Most of the impact should be on the Trading Book. However, some risks, like foreign exchange, commodity and settlement, are also computed for the Banking Book. My approach was to use the most comprehensive measure, using Trading and Banking books.
Operational Risk effect	It is the change in the total amount of operational risk, measured as the capital requirement for this type of risk multiplied by 12.5. A positive number means more operational risk.
cross effect	The use of a chain decomposition creates always some residual effect from the cross effect of the risks. It is a small number that can be ignored.

Speed and Quality of bank adjustments to target capital ratios

Gonçalo Leónidas Rocha

PhD student at NOVA School of Business and Economics

goncalo.l.rocha@novasbe.pt

June 2015

ABSTRACT

In this paper, I investigate the speed of adjustment and the quality of capital to fill the gap between current capital ratios and bank internal capital targets.

If regulators ask for speed, they get quality capital from banks; however, if they ask for capital, banks do not deliver speed, mainly when they are very profitable and can count on future equity accumulation to fill the gap.

On average, capital accounts only for 26% of the adjustment effort to target ratios. I also found a 0,47 yearly adjustment factor, meaning that banks adjust every year about half of the distance they have between current capital ratio and the target value. This value is consistent with an industry average optimal capital ratio of 15.2%, significantly higher than minimum required.

Banks that adjust faster and with good quality tend to have a lower initial Tier 1 ratio, high Return on Assets, riskier assets and be located in developed markets.

JEL Classification: G280

Keywords: Bank, Regulation, Capital Adequacy, Basel III

1 Introduction

There is a significant body of literature discussing the existence of target capital structures, be it in banks or in non financial firms. The idea is not exempt from controversy, mainly after the seminal work of Modigliani & Miller (1958) that presents the irrelevancy proposition. Only in the presence of market frictions could the capital structure have some impact of the value of the firm. In the financial industry, no one seems to claim that structure is irrelevant, and all Basel regulation, directed to capital adequacy, supports a general consensus in that matter.

In this paper, I discuss the way banks adjust to a new environment where significant increases in capital are required. Three main factors seem to contribute for the change in capital structure. In the first place, after the shock of the global financial crisis of 2008, banks may have realised they were underestimating risks; economic capital should be higher, leading banks to reduce leverage. The second factor is the adjustment in the asset side, due again to the shock waves of the global financial crisis. Here, the impact is not obvious, as we witnessed a major divergence between banks facing significant capital challenges and the ones, mainly in emerging markets, that profit from the situation to increase market share in global markets. Finally, regulators came aboard and required more capital, even when banks are not willing to do so.

My approach is to study the dynamics of two variables: the degree of capital usage and the speed of the adjustment.

In principle, regulators may prefer that banks adjust to the new requirements using capital. However, the result is not so obvious. For instance, if leverage and risk are close substitutes, banks may increase risk when leverage is limited by regulation below their optimal level - Shrieves & Dahl (1992) support this theory (however, they found this also happens for banks above the minimum requirements, and so regulation is not

the only reason for the fine tuning of the mix; shareholders and managers preferences must also play a role here). We found on a previous paper[42] that a mandatory increase in capital changed the ownership structure of the bank and, with that, the level of risk appetite.

In this paper, I use an extended database, with more banks, spread for all geographies, and also using some privately owned banks. Instead of just presenting the path banks use to fulfill required ratios, I also discuss the characteristics that contribute for different speeds and capital usage.

In the second part of this paper, I review the literature on the existence of target capital ratios, and on how banks approach those targets. In the third part, I will present the database used in the paper and some characteristics of the data. The implementation of the variables ”capital usage” and ”speed of adjustment” are discussed.

At part 4, on the methodology and empirical tests, I perform 3 tests on the data. The first test is a linear regression, using capital usage and speed of adjustment as dependent variables, in order to discuss what factors condition their behavior. My second test combines both variables and tries to discuss which conditions might favour high speed and high capital, and also what can contribute for the opposite behavior (low speed and low capital). A probit test is used for that matter.

In the first two tests, I considered the capital ratio of 2013 to be the target ratio for each bank. This might be a simplification, and so I use a possible estimation for the banking industry target ratio, based on the yearly adjustment factor to that target. Some insights are taken from the full database, and also from a split between European and non European banks.

[42]Rocha (2013)

Part five concludes and presents some take aways for regulation and avenues for future research.

2 Review of the Literature

The leverage ratio has been researched in the literature for long, be it in financial or non-financial companies. For instance Flannery & Rangan (2006) found that companies have a target leverage ratio and they tend to adjust one third of the gap each year. They also found (but do not report) that firm characteristics affect the speed of adjustment. Basel III sets a new dynamic target, as each year has a new level to be achieved until 2019; however, in this case, banks cannot adjust slower, but they can do it faster (or have a higher target - see for instance Shrieves & Dahl (1992) that find banks try to maintain a buffer above regulatory minimum as a flexibility option). However, we should bear in mind that a high buffer may mean two different things: on one hand, it can be a "safety" stance from the bank (when running at below level is costly or the access to capital markets is not quick or readily available); or it may just reflect the riskiness of the bank, where economic capital is way above regulatory capital.

A study by Jokipii & Milne (2008) finds the adjustment speed to be higher in banks (two thirds of the gap each year), which can be a consequence of regulatory pressure or the fact that banks can more easily adjust their ratios on the asset side (banks have a larger percentage of liquid assets when compared to non financial companies). The paper also finds some relationship between adjustment and size. Large banks seem to decrease the buffer in bad times, whereas smaller banks tend to increase the buffer.

Putting crudely, we could say that smaller banks foresee a crisis coming and adjust their loan policy in advance, lowering risks and economic capital. Since it is not thinkable that large banks have lower predictive power, we have to look for other explanations, like a lower capacity of adjustment or a higher reliance on the Government safety net in case of need.

Memmel & Raupach (2010) use a monthly data sample of German banks to confirm the higher speed of adjustment for banks, and also that privately owned banks adjust faster than state owned or cooperative banks. I cannot find this results with my database. The authors use the proportion of market risk in total Risk Weighted Assets as a proxy for proprietary trading. Since I have a much wider database, I lack this information for a significant part of the banks. As such, I used the net value of securities in banks assets as a proxy and I could not find that relationship when speed of adjustment is considered alone. However, I find a significant probability that a higher proportion of securities in the balance sheet leads to higher speed and capital usage taken together. The different conclusion may be due to the several roles securities play on the bank balance sheet, to the existence of pledged securities, or to impairments.

Cohen & Scatigna (2014) address the issue of what instrument is responsible for the adjustment. Using a database of 94 large global banks, the authors found that the bulk of the adjustment towards new capital requirements was done with retained earnings (less generous dividends) and much less with reductions in the risk profile of the assets.

Gropp & Heider (2009) finds that deposit insurance and capital requirements play a secondary role on the capital structure of banks (mainly when they are close to minimum requirements). According to the paper, the primary determinant is bank specific and time invariant targets (call it culture). This evidence is supported by the fact that very profitable banks, that pay generous dividends and have high market to book ratios

(and so without any substantial cost to deal with the need to raise capital, or less flexibility value), do have larger buffers. In this setting, banks behave like any non-financial firm.

Francis & Osborne (2012) have an interesting and unique database: they use bank specific regulation, or the capital adjustments required in the UK for each bank, taking into account governance, risk management and market environment. This approach is interesting as an 8% fixed threshold is not a good proxy for an unconstrained bank (markets and regulators may be imposing higher levels). The study finds that loan growth is positively associated with high target capital level, but not so with required capital level. If a well capitalized bank has better chances of increasing the loan book, this effect does not happen when the bank is still adjusting to the preferred target level. A bank with a low capital target level will have the incentive to comply to the regulation with the lower quality capital accepted, like tier II instruments. A regulatory imposition might lead to this type of behavior: high quality capital must be demanded and, even so, banks can play with the level of assets or the risk weights.

3 Data and Summary Statistics

This database was already used in a previous paper[43].

The data-set used here is compiled from annual reports and pillar 3 disclosures from the largest banks in the world. In this sample, I consider all banks that, in the starting year of 2008, have at least 40 billion US dollars of assets. In total, there are 215 bank-

[43] See Rocha (2015).

ing groups complying to this criterion, from which I can work with 184. The remaining banks have very little information (unfortunately, this is not a "random" selection, as banks with missing information are much less reliant on the markets for funding or business).

Then, I computed two new variables: the degree of **capital usage** (the numerator) instead of RWA (the denominator) to fill the gap; and the **speed of adjustment**, revealing the pace of such adjustment.

The capital usage is the percentage of Tier 1 ratio change during the period that is attributed to changes in the numerator. The computation is done like this:

$$capital\ usage = \frac{(\frac{Tier1_{2013}}{RWA_{2013}} - \frac{Tier1_{2008}}{RWA_{2013}})}{\frac{Tier1_{2013}}{RWA_{2013}}} = 1 - \frac{Tier1_{2008}}{Tier1_{2013}} \tag{18}$$

In principle, capital usage should lie between 0% and 100%; however, since it can contribute positively or negatively to the outcome, the variable has no bounds.

This method assumes the ratio in 2013 is the desired target[44], which is a strong assumption. Furthermore, the ratio may not even be desired, but the consequence of the environment: a bank with significant losses may have a negative capital contribution.

The speed of adjustment weights each year the change in the capital ratio (as a percentage of the total change during the five year period) by a load factor that identifies the year of the change. A change in 2009 has a weight of 5, whereas a change in 2010 has a weight of 4, and so on. A high number means a fast increase. The variable can have a value in excess of 5, as there might be negative numbers in some years.

[44] I will relax this constraint in the next section.

In **Table 21**, I present a set of descriptive statistics of the data.

Table 21

This table reports descriptive statistics for the variables used in this paper. The source and exact meaning of each variable is described in Annex 2.

	Max	Min	Average	Median	# observ.
Asset Volatility	0,420	0,017	0,140	0,108	184
Capital usage	82,0%	-80,9%	26,4%	27,0%	184
Creditor Rights	4,00	0,00	2,03	2,00	182
Emerging					45
European					80
Final Tier 1	127,9%	6,6%	13,9%	12,3%	184
GDP per capita	106 820	1 358	37 492	41 968	174
Initial Tier 1	125,6%	5,0%	10,9%	9,4%	184
Leverage	277,56	-66,76	21,18	16,93	184
Loan to Deposits Gap	27,25	-0,98	0,48	-0,03	183
Log of Asset Size	19,46	8,70	13,46	13,23	184
Power Owner Share	100,0%	5,0%	44,2%	34,4%	184
ROA	2,3%	-6,5%	0,3%	0,3%	184
ROE	860,5%	-616,0%	5,1%	6,9%	184
Securities	89,8%	3,6%	27,9%	24,8%	184
SIFI 2014					26
Speed of Adjustment	44,1	-80,2	3,0	3,4	184
Spread	5,7%	-0,4%	1,7%	1,5%	184
Regulatory Tier 1	11,0%	8,5%	8,7%	8,5%	184
WGI	11,09	-4,42	5,94	7,29	184
Z Score	384,20	-0,46	46,27	30,55	184

On average, banks increased their Tier 1 ratios by 3 percentage points during this 5-year period, and they used capital to fill 26,4% of the distance to their target Tier 1 ratio, which is quite a small figure. However, most banks already had Tier 1 ratios aligned with the requirements from Basel III.

Speed of Adjustment tells that, on average, banks adjusted to the target level in 3 years.

Banks from Taiwan had no value for GDP per capita. The use of the Chinese figure is unsuitable and the World Bank does not compute a regional GDP for Taiwan (however, the World Bank computes a regional GDP for Hong Kong...).

4 Methodology and Empirical Tests

Standalone effects

I have run a linear regression on the speed of adjustment. Results are presented on **Table 22**. The first thing to note is that bank profitability decreases the speed of adjustment; we can see that on the negative coefficients of ROE and spread. It might be counter-intuitive; however, profitable banks have a better expectation to fulfill the target ratios without specific events, like capital issues or significant asset reshuffle.

The use of capital increases the speed, as it is probably the way to change the ratio overnight. I run other regressions with the level of securities in the balance sheet and we found no meaningful relationship. We might suspect that a significant part of the security portfolio is already pledge (and thus not really available to sell) or with sig-

nificant impairments through equity that banks are reluctant to bring to the P&L.

Another interesting note was the behavior of state owned banks (not reported). I would expect some slower speed of adjustment. However, the numbers do not show that. We have to bear in mind the significant number of sate owned banks in emerging markets, where the profitability was very relevant during the period of analysis.

A linear regression was also made to explain the level of capital usage for the adjustment. Results are presented as **Table 23**.

In this case, the conclusions are more obvious. Profitability builds capital and so increases the level of capital usage. A low initial Tier 1 ratio also calls for more capital, maybe done through an equity-like issue, as the normal course of business would not be enough to achieve the target.

More interesting is the size effect: largest banks tend to be listed, and the market called for a quick recover of the ratios (and were available to provide the funding). Also bear in mind that SIFI banks have higher targets.

A low WGI score is a proxy for emerging markets, and so the negative coefficient represents a higher usage of capital from those banks. This is explained by the significant increase in asset size during the period, where these banks suffered very little from the global financial crisis. As such, only capital helped to build up ratios, as the denominator was mainly pushing Tier 1 down.

Combined effects

In the previous section, I study the impact of several bank and country characteristics on the speed of adjustment and capital usage, on a standalone basis. I did not study what type of characteristics could lead banks to simultaneously have a high speed of adjustment and significant capital usage.

In this section, I combine both variables. In a way, regulators prefer banks to recover capital ratios fast, using the most ”capital-like” instruments they can use.

I started by constructing 4 simple quadrants, divided by the median value for speed of adjustment and capital usage. Then, I run a probit for the probability of a bank to lie on the top quadrant (high speed of adjustment and high capital usage) and also on the bottom quadrant (low speed of adjustment and low capital usage)[45]. The other two quadrants were ignored. The results are presented as **Table 24**.

The first conclusion, largely expected, is that a high initial Tier 1 ratio reduces the impetus to have a high speed and high capital contribution. The mirror effect is also true: a low initial ratio increases the urgency of the adjustment, and with good quality instruments. By the same token, a high Return on Assets increases the speed and quality of the adjustment, as the profitability of the banks helps to recover Tier 1; a low ROA reduces the speed and quality of the adjustment.

Another factor that stands up as contributing for speed and quality is the volatility of assets. However, this effect might be the result of the construction: as the volatility was computed for the same period of the change in the ratio, there is a feed loop here.

[45]The names ”top quadrant” and ”bottom quadrant” are not exactly correct, but they are intuitive for the behaviour.

More interesting is the percentage of securities in the balance sheet. In line with the findings of Memmel & Raupach (2010), I witness that banks with significant securities can adjust faster. However, I find this effect only when quality is also present. The interpretation might be due to the construction of this test: the level of securities in the balance sheet is largely irrelevant *on average* to the quality or the speed of adjustment. However, banks that showed a significant higher speed and quality used all the means they had to do so, and the level of securities helped on this. When speed of adjustment and/or quality is not pursued or possible, the level of securities is less relevant.

For the same Tier 1 ratio (which is a variable also present in the Probit test), lower leverage helps to increase speed and quality. This situation happens for banks with more risky assets, and so the ratio of total assets to RWA is lower (or, more intuitive, the ratio of RWA to total assets is higher).

$$leverage = \frac{Assets}{Equity} = \frac{Assets}{RWA} \times \frac{RWA}{Equity} = \frac{Assets}{RWA} \times \frac{1}{Tier\ 1\ ratio} \tag{19}$$

Summing up, banks with riskier assets need to adjust faster and with capital. Several situations can lead to this: reduced exposure to safe securities, long term and/or reduced collateral for the loans, and so on. With this setup, it is more difficult for the bank to expect that the passage of time or asset reshuffle can help to adjust the ratio. Furthermore, riskier assets are linked to higher economic capital, and a probable longer path to their preferred target ratio.

Consistent with the findings in a previous paper[46], size seems not to induce banks to increase speed and quality (nor decrease, for that matter), the same effect as the SIFI qualification.

[46]Rocha (2015).

A final note to emerging market banks that seem to take more time and less quality to adjust (eventually less pressed from capital markets and with better tail wind from economic environment).

Estimating the industry target ratio

Until now, I used the observed Tier 1 ratio in 2013 as a proxy for the target ratio on that same year. This assumption is probably quite strong. Banks may have internal target ratios that they could not reach in a given year. Since I was considering that the 2013 capital level is the target, I was placing at the same level a bank that barely complies with the regulatory minimum and another one that significantly surpasses that level.

There is an extensive literature confirming the existence of target capital ratios in financial and non financial sectors. In the banking industry, it is not only market pressure (like rating) or strategy to command the target, as also regulation plays a binding role. Banks cannot operate below regulatory capital, and should not operate away from economic capital. We can say that available capital should be the higher number of the two. However, a very tight linkage to that number can be considered a loss of flexibility, and markets might compensate banks for operating above strict minimum.

Some authors use a *lambda* coefficient to model the yearly adjustment for the gap between current level and the desired target for next year. The following equation can be considered (where K^* refers to the optimal or target level):

$$K_{i,j+1} - K_{i,j} = \lambda(K^*_{i,j+1} - K_{i,j}) + \epsilon_{i,j+1} \tag{20}$$

However, something must be inferred about this *lambda* coefficient. It can be fixed for all banks, which is what most authors use, as can be seen for instance on Flannery & Rangan (2006) or Jokipii & Milne (2008). It might seem quite strong but it is more apparent than true. In fact, the adjustment is done to an unobserved target: if the true *lambda* for a bank is higher than our overall guess, it means that we are overestimating the target capital level of that bank. If we let *lambda* to move among banks, we will not be able to infer target levels. Since I am interested in the estimation of an industry adjustment ratio, and not a bank specific ratio, bank idiosyncrasies are mainly noise and should average to zero. Also, note that Roberts (2002) found that *lambda* is not fixed but industry explains most of the difference among firms. Since I am are using a single industry, the use of a fixed *lambda* should not impose significant bias on the conclusions.

Let us assume that target ratios are a function of some bank, regulation and country characteristics, denoted by a vector $X_{i,j}$. Then it can be said that:

$$K^*_{i,j+1} = \beta X_{i,j} \tag{21}$$

Composing (20) and (21) and rearranging, we get:

$$K_{i,j+1} = (1-\lambda)K_{i,j} + \lambda\beta X_{i,j} + \epsilon_{i,j+1} \tag{22}$$

The results of regression (22) are presented in **Table 25**. I used firm fixed effects since, when omitted, coefficients are severely biased (see Flannery & Rangan (2006) on this particular topic). The estimation for banking *lambda* is 0.47, or 1 less the beta coefficient of the Ki,j variable.

Given the average Tier 1 capital increase of 0,6% every year for our sample, this corresponds to a target Tier 1 ratio 1,27% above current levels, or 15,2% on average.

Larger banks seem to increase capital ratios slowly, whereas significant loan provision in the past tends to command higher increases in Tier 1 capital afterwards. High Return on Assets ratio tends to decrease the pace of Tier 1 accumulation.

It is also interesting to find a positive coefficient on the Output Gap variable, supporting the idea that bank capital is pro-cyclical: it tends to increase more when the economy is booming. This seems to be obvious, but is not. In fact, before the financial crisis of 2007-08, most research[47] found the opposite effect, pointing to a "defensive" stance from the banks: when the economy is booming, banks can safely run with less excess capital. After the crisis, banks have to increase capital, and cannot "crowd-out" the cycle with less capital, as they used to do.

The coefficient of the year is also positive and significant, consistent with an acceleration of capital build-up.

In **Table 26**, I split the sample between European and Non European banks. The results are striking. The *lambda* coefficient is much higher in Europe[48]. This may represent a lower target or a higher pace. The coefficient for the Year is also higher in Europe, showing a faster acceleration.

Some variables lose significance in the European group, as there is much less variance inside the sample, like the Emerging dummy, Creditors Rights, Asset Size or the

[47] See Jokipii & Milne (2008), Ayuso *et al.* (2004), Lindquist (2004) and Stolz & Wedow (2011). This last paper uses a database from 1993 to 2004.

[48] Remember that *lambda* is 1 minus the $K_{i,j}$ coefficient.

Z Score.

The Output Gap is very significant and positive in Europe, contrasting with no significance in their Non European counterparts. One possible interpretation is the consistence in Europe that capital ratios are bound to increase, and so every good opportunity, like a better economic environment, should be used to fill the target. On the other hand, Non European banks are less consistent on this respect. A favourable economic environment means less credit risk. Economic capital is certainly lower, and banks seem to use that to reduce the ”observed” buffer to regulatory levels.

From **Table 27**, it is evident that European banks showed a much faster pace during the period of analysis. From a evident lower level in 2008, European banks managed to surpassed their Non European counterparts by 2013. In this last year, Non European banks showed even a slight average decrease in their Tier 1 capital ratio. However, due to a lower estimated target Tier 1 ratio, Non European banks are closer to fulfil the gap. For the European banks, another year with the pace of 2013 is sufficient to meet the target required in 2013.

These findings are consistent with the idea that banks have significant buffers on top of the minimum required capital level. In this post-crisis years, banks seem not to profit from good economic conditions to reduce the buffer.

5 Conclusions

In this paper, I investigate the speed of adjustment and the quality of capital to fill the gap between current capital ratios and bank internal capital targets. The existence of optimal capital targets, way above the minimum regulatory requirements, seems to find support in the literature.

When taken in a standalone basis, we see a divergent pattern: if regulators ask for speed, they get quality capital from banks[49]; however, if they ask for capital, banks do not deliver speed, mainly when they are very profitable and can count on future equity accumulation to fill the gap.

On average, capital accounts only for 26% of the adjustment effort to target ratios. This seems a very low figure, maybe explained by a very difficult period of analysis (with economic recession in several countries) and the generous time frame given by Basel III. Size and the SIFI status help to achieve a better quality adjustment. However, they are not meaningful if regulators want speed and quality together.

Banks that adjust fast and with good quality tend to have a lower initial Tier 1 ratio (in 2008), high Return on Assets, riskier assets and be located in developed markets.

I have also tried to estimate the yearly adjustment of the banking industry towards optimal target ratios. I found a 0,47 adjustment factor, meaning that banks adjust every year close to half of the distance they have between current capital ratio and the target value for the same indicator. This value is consistent with an industry average optimal capital ratio of 15.2%, significantly higher than minimum required.

[49] It is easier to increase ratios with equity issues than by reshuffling assets. This argument is used by Admati & Hellwig (2013) to criticize strongly the option from Basel III to give a very large time frame, until 2019, to strengthen capital.

Capital ratios seem to be pro-cyclical after the financial crisis of 2007-2008, a structural change when compared to the research produced before the crisis. In my view, banks can no longer profit from a positive economic cycle to reduce the effort in their endogenous effort to adjust ratios.

European banks adjusted much faster during the period of analysis, being able to recover from an initial lower ratio and even surpass the level of their Non European counterparts. The pace was even accelerating during the period.

As a take-away for regulation, it seems that speed is the variable to demand, as quality comes with it. When Basel III decided to be generous with timing, markets were depressed and there were reasonable doubts that most banks could recover capital fast and all at the same time. Now that capital markets reopened for banks, regulation seems a non-binding requirement, as banks run at much higher levels and adjust much faster than needed, due to their own economic capital assessment or to the value posted on flexibility or on the capacity to resist in a downturn.

For future research, it is interesting to model bank individual target ratios and try to explain what motivates those different behaviors inside the industry.

6 Tables

Table 22

This table reports results of a linear regression of *speed of adjustment*, as the dependent variable, on several regressors. Sample consists of the largest 184 banks in the world, all with total assets in 2011 above USD 40 bn. Statistics are based on annual data for the years 2008 to 2013. The meaning of all variables is detailed on Appendix 2. T-stats for each coefficient are reported in parenthesis. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	Speed of Adjustment		Fixed Effects	
Intercept	-0,5674			
	(-0,1270)			
Capital usage	6,4105	**	0,0312	**
	(2,3840)		(2,1730)	
Asset Volatility	9,0789		0,3840	
	(1,2770)		(0,8730)	
Spread	-167,6196	**	0,0993	*
	(-2,4090)		(-1,6580)	
Log of Asset Size	0,3762		0,0849	*
	(1,2580)		(1,7340)	
Leverage	-0,0678	*	0,1325	
	(-1,7000)		(-1,7000)	
ROE	-3,4516	***	0,0032	***
	(-3,3380)		(-2,9910)	
Power Owner FE	No		Yes	
Statistics				
R Square	0,1305		0,1864	
F Statistic	4,4270	***	2,1000	***
# Independent variables	6		18	
# Degrees of Fredom	177		165	
# Observations	184		184	

Table 23

This table reports the results of a linear regression of *capital usage*, as the dependent variable, on several regressors. Sample consists of the largest 183 banks in the world (one bank, Bank Nederlandse Gemeenten, has no deposits, and so the Loan to Deposits gap cannot be calculated), all with total assets in 2011 above USD 40 bn. Statistics are based on annual data for the years 2008 to 2013. The meaning of all variables is detailed on Appendix 2. T-stats for each coefficient are reported in parenthesis. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively. 1 observation deleted due to missingness.

	Base Model		Fixed Effects	
Intercept	0,1676			
	1,4320			
Speed of Adjustment	0,0032	*	0,0032	*
	1,7150		1,7170	
Asset Volatility	0,2024		0,2199	
	1,0920		1,1620	
Initial Tier 1	-0,1138		-0,3134	*
	-0,7740		-1,7950	
Loan to Deposits Gap	-0,0099		-0,0084	
	-1,5420		-1,2710	
Log of Asset Size	0,0130	*	0,0159	*
	1,7040		1,9060	
ROE	0,0362	**	0,0448	**
	2,0000		2,4780	
ROA	6,8040	***	6,6558	***
	3,9970		3,8350	
WGI	-0,0234	***	-0,0232	***
	-5,0730		-4,7740	
Z Score	0,0004		0,0005	*
	1,2890		1,7740	
Power Owner FE	No		Yes	
R Square	0,3854		0,4463	
F Statistic	12,0500	***	6,1790	***
# Independent variables	9		21	
# Degrees of Freedom	173		161	
# Observations	183		183	

Table 24

This table reports the results of a probit test on the quadrant each bank lies on its adjustment to the target levels. The top quadrant includes banks that revealed an above median speed of adjustment and also above median usage of capital. The bottom quadrant includes banks that revealed a below median speed of adjustment and also below median usage of capital. Sample consists of the largest 184 banks in the world, all with total assets in 2011 above USD 40 bn. Statistics are based on annual data for the years 2008 to 2013. The meaning of all variables is detailed on Appendix 2. T-stats for each coefficient are reported in parenthesis. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	top quadrant			bottom quadrant		
	estimate	z value		estimate	z value	
(Intercept)	6,5750	1,1520		5,7900	0,8200	
Asset Volatility	4,8980	3,1260	***	-2,2620	-1,3570	
Creditors Rights	0,2383	1,6670	*	-0,0118	-0,0840	
Emerging	0,6452	0,9350		-4,9910	-2,0870	**
European	-0,3619	-0,8400		-0,1261	-0,3540	
GDP per capita	0,0000	2,0390	**	0,0000	-1,1000	
Initial Tier 1	-29,4200	-4,2450	***	17,2500	2,8960	***
Leverage	-0,0436	-2,2720	**	0,0073	0,9020	
Loan to Deposits Gap	-0,1423	-0,7020		-0,0115	-0,2320	
Log of Asset Size	-0,0121	-0,1460		-0,1067	-1,4030	
State owned	0,0612	0,1630		0,0861	0,2320	
ROA	69,8600	2,3850	**	-67,5500	-2,5330	**
ROE	-0,8209	-1,2940		0,2832	0,9720	
Securities	3,9740	3,0930	***	-0,7250	-0,6490	
SIFI 2014	1,1250	1,2250		0,4782	0,4280	
Regulatory tier 1	-83,8700	-1,2980		-62,5600	-0,7640	
Z Score	-0,0005	-0,1780		0,0017	0,6400	
AIC	172,75			184,21		
# observations	171			171		

(13 observations deleted due to missingness on both tests)

Table 25

This table reports the results of the regression in equation (4). The Tier 1 ratio of any given year ($K_{i,j+1}$) is estimated based on the previous year Tier 1 ratio ($K_{i,j}$) and a set of bank and country characteristics ($X_{i,j}$). Sample consists of the largest 184 banks in the world, all with total assets in 2011 above USD 40 bn. Statistics are based on annual data for the years 2008 to 2013. The meaning of all variables is detailed on Appendix 2. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	Estimate	t value	
(Intercept)	-5,93100	-3,87100	***
$K_{i,j}$	0,53280	13,09000	***
Asset Volatility	-2,04700	-2,75800	***
Creditor Rights	0,12670	2,52300	**
Emerging	0,28580	2,54600	**
European	0,21970	3,01100	***
Leverage	-0,00004	-1,25400	
Loan to Deposits Gap	0,00045	0,45000	
Loan Risk	0,08979	1,14500	
Log of Asset Size	-0,03958	-2,61500	***
GDP per Capita	0,00000	-2,13700	**
ROA	-0,61470	-6,80100	***
Securities	0,03168	1,39000	
Spread	0,31020	1,02300	
Output Gap	0,00190	4,09500	***
Year	0,00306	3,95200	***
WGI	0,00116	0,29900	
Z Score	-0,00016	-1,51000	
Multiple R-squared:	0,9253		
F-statistic:	44,61		
# Independent variables:	154		
# Degrees of Freedom:	555		
# Observations:	710		

(210 observations deleted due to missingness)

Table 26

This table reports the results of the regression in equation (4), split between European and non-European banks. The Tier 1 ratio of any given year ($K_{i,j+1}$) is estimated based on the previous year Tier 1 ratio ($K_{i,j}$) and a set of bank and country characteristics ($X_{i,j}$). Sample consists of the largest 184 banks in the world, all with total assets in 2011 above USD 40 bn. Statistics are based on annual data for the years 2008 to 2013. The meaning of all variables is detailed on Appendix 2. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively.

	European			Non European		
	Estimate	t value		Estimate	t value	
(Intercept)	-14,50000	-6,17500	***	-4,36500	-1,90100	*
$K_{i,j}$	0,24470	3,62000	***	0,60090	12,44700	***
Asset Volatility	-0,91600	-2,31700	**	0,96450	3,51600	***
Creditor Rights	0,06503	1,93900	*	0,16600	3,20500	***
Emerging	0,07590	1,16500		-0,33370	-3,88700	***
Leverage	-0,00002	-0,60800		-0,00038	-0,84800	
Loan to Deposits Gap	0,00240	1,53700		0,00000	0,00300	
Loan Risk	0,11940	1,29200		0,01756	0,10000	
Log of Asset Size	-0,01944	-0,92900		-0,05610	-2,60600	***
GDP per Capita	0,00000	-1,17500		0,00000	-1,00500	
ROA	-0,47990	-3,84700	***	-0,65150	-3,81400	***
Securities	0,04261	1,28500		0,02665	0,95000	
Spread	0,07064	0,11500		0,46550	1,57300	
Output Gap	0,00250	3,57200	***	0,00087	1,41000	
Year	0,00731	6,20400	***	0,00224	1,92100	*
WGI	0,00763	1,43500		0,00040	0,07900	
Z Score	0,00018	1,46600		-0,00135	-5,78200	***
Multiple R-squared:	0,7461			0,9765		
F-statistic:	9,741			133,3		
# Independent variables:	89			77		
# Degrees of Freedom:	295			247		
# Observations:	385			325		
# Observations deleted:	15			195		

Table 27

This table presents a summary of the findings of adjustments speeds between European and Non European banks. In this table, *lambda* is computed from the regression coefficient of $K_{i,j}$ from tables 5 and 6. Gap to target Tier 1 ratio is simply the ratio between the average adjustment and the *lambda* coefficient. Sample consists of the largest 184 banks in the world, all with total assets in 2011 above USD 40 bn. Statistics are based on annual data for the years 2008 to 2013. The meaning of all variables is detailed on Appendix 2.

	All	European	Non European
lambda	0,4672	0,7553	0,3991
Average adjustment	0,593%	1,037%	0,251%
Average 2013 adjustment	0,564%	1,300%	-0,002%
Gap to target Tier 1 ratio	1,268%	1,373%	0,628%
Average Tier 1 in 2008	10,93%	9,14%	12,31%
Average Tier 1 in 2013	13,89%	14,32%	13,56%
Tier 1 Target	15,16%	15,69%	14,19%

Variables used

Variable	Comment
Bank	
Asset Size	Log of total assets in USD Bn. Numbers were collected from the consolidated annual reports.
Asset Volatility	Standard deviation of Asset Size, divided by the average Asset Size, using fiscal year-end figures for the period 2008-2013. Numbers were collected from the consolidated annual reports.
Capital Usage	Percentage of the change in Tier 1 ratio that is explained by the effect of the numerator. A more comprehensive explanation is given on Data & Summary Statistics section.
Country	Country of incorporation.
Emerging	A dummy variable that assumes a value of 1 when the country of incorporation is considered Emerging by the classification of the IMF.
European	A dummy variable that assumes a value of 1 when the country of incorporation is in Europe. Countries in two continents were placed where they have most of their land, and so Russia and Turkey are considered non-European.
Final Tier 1	The ratio of Tier 1 capital reported by the bank for the fiscal year of 2013. Numbers were collected from the consolidated annual reports.
Leverage	The ratio of total assets over total equity. Numbers were collected from the consolidated annual reports.
Initial Tier 1	The ratio of Tier 1 capital reported by the bank for the fiscal year of 2008. Numbers were collected from the consolidated annual reports.
Loan Risk	Total loan provision as a percentage of gross loan book. Numbers were collected from the consolidated annual reports.
Loan to Deposits gap	Net loans granted to clients as a percentage of total deposits from clients. Numbers were collected from the consolidated annual reports.

Variables used (cont.)

Variable	Comment
Bank	
% Ownership of the Controlling Owner	Percentage economic rights of the largest shareholder of the bank, provided it has at least 5% share. When that threshold is not met by any single shareholder, the bank is considered owned by the free float, and the percentage of free float is reported.
ROA	The average Return on Assets of the bank for the period 2008-2013. Numbers were collected from the consolidated annual reports.
ROE	The average Return on Equity of the bank for the period 2008-2013. Numbers were collected from the consolidated annual reports.
Securities	Average (for the period 2008-2013) percentage of total assets represented by securities, including trade, available-for-sale, held-to-maturity, fair value, hedging derivatives and repo portfolios. Numbers were collected from the consolidated annual reports.
SIFI 2014	A dummy variable that assumes a value of 1 when the bank is in the list of Global Systemically Important Financial Institutions in 2014. The list is published by FSB - Financial Stability Board
Speed of Adjustment	A proxy for the number of years on average that banks took to overcome the difference between the initial Tier 1 ratio and the final Tier 1 ratio. The formula used is explained in detail on Data & Summary Statistics section.
Spread	For each year, the spread is computed as the Net Interest Margin over Total Assets. The variable used here is the average spread for the period 2008-2013. Numbers were collected from the consolidated annual reports.
Regulatory Tier 1	The ratio of Tier 1 capital required by Basel III ”fully loaded”. It incorporates also the extra charges for Global SIFI - Systemically Important Financial Institutions.
Z-Score	See Boyd & Graham (1986). It is a score that represents the number of standard deviations of profits over total assets needed to wipe out equity over total assets (assumes a normal distribution of returns). A high score means a safer bank. See Appendix 4 of Rocha (2013) for an explanation of the variable.

Variables used (cont.)

Variable	Comment
Country	
Creditor Rights	Creditor Rights Index, collected from Djankov & Shleifer (2007). This variable measures the legal rights of the creditors against defaulting debtors in each country.
WGI Index	Worldwide Governance Indicator for each country prepared by Kaufmann *et al.* (2010). The variable incorporates different issues like accountability, violence, corruption, rule of law, quality of regulation and government effectiveness.
GDP per capita	Values in current USD. The source is the World Bank.
Output Gap	Deviations of actual GDP from potential GDP as % of potential GDP. The source is OECD. Data is only available for developed countries.

Country variables assume the same number for all banks in the same country. We do not use Chinese data to model banks from Taiwan or Hong Kong.

References

Admati, Anat R, & Hellwig, Martin F. 2013. *The Bankers' New Clothes: What's Wrong with Banking and What to Do about It*. Princeton University Press.

Aggarwal, Reena, Erel, Isil, Ferreira, Miguel A, & Matos, Pedro. 2009 (July). *Does Governance Travel around the World? Evidence from Institutional Investors*. Tech. rept. Charles A. Dice Center for Research in Financial Economics, Fisher College of Business.

Ayuso, Juan, Perez, Daniel, & Saurina, Jesus. 2004. Are capital buffers pro-cyclical?: Evidence from Spanish panel data. *Journal of Financial Intermediation*, **13**(2), 249–264.

Bae, Kee-Hong, & Goyal, Vidhan K. 2009. Creditor Rights, Enforcement, and Bank Loans. *Journal of Finance*, **64**(2), 823–860.

Barry, Thierno Amadou, Lepetit, Laetitia, & Tarazi, Amine. 2011. Ownership structure and risk in publicly held and privately owned banks. *Journal of Banking & Finance*, **35**(5), 1327–1340.

Barth, James R, Nolle, Daniel E, & Rice, Tara N. 1997. Commercial Banking Structure, Regulation, and Performance: An International Comparison. *Managerial Finance*, **23**(11), 1–39.

Barth, James R, Caprio Jr., Gerard, & Levine, Ross. 2000 (Nov.). *Banking systems around the globe : do regulation and ownership affect the performance and stability?* Tech. rept.

Basel. 2010 (Jan.). *Basel III: A global regulatory framework for more resilient banks and banking systems*.

Beltratti, Andrea, & Stulz, René M. 2009 (Nov.). *Why Did Some Banks Perform Better During the Credit Crisis? A Cross-Country Study of the Impact of Governance and Regulation*. Tech. rept.

BIS. 2014. *Annual Report 2013*. Tech. rept. April 2013. Bank of International Settlements.

Blum, Jürg M. 2008. Why 'Basel II' may need a leverage ratio restriction. *Journal of Banking & Finance*, **32**(8), 1699–1707.

Boyd, John H, & Graham, Stanley L. 1986. Risk, regulation, and bank holding company expansion into nonbanking. *Quarterly Review*, July, 2–17.

Brandao Marques, Luis, Correa, Ricardo, & Sapriza, Horacio. 2013. International Evidence on Government Support and Risk Taking in the Banking Sector. *SSRN Electronic Journal*, Aug.

Buser, Stephen A, Chen, Andrew H, & Kane, Edward J. 1981. Federal Deposit Insurance, Regulatory Policy, and Optimal Bank Capital. *Journal of Finance*, **36**(1), 51–60.

Camara, Boubacar, Lepetit, Laetitia, & Tarazi, Amine. 2013. Ex ante capital position, changes in the different components of regulatory capital and bank risk. *Applied Economics*, **45**(34), 4831–4856.

Caprio Jr., Gerard, & Honohan, Patrick. 1999. Restoring banking stability: Beyond supervised capital requirements. *Journal of Economic Perspectives*, **13**(4).

Caprio Jr., Gerard, & Klingebiel, Daniela. 1997. Bank Insolvency: Bad Luck, Bad Policy, or Bad Banking? *The World Bank*.

Caprio Jr., Gerard, Laeven, Luc, & Levine, Ross. 2007. Governance and bank valuation. *Journal of Financial Intermediation*, **16**(4), 584–617.

Cohen, Benjamin H. 2013. How have banks adjusted to higher capital. *BIS Quarterly Review*, 25–41.

Cohen, Benjamin H, & Scatigna, Michela. 2014. Banks and Capital Requirements: Channels of Adjustment. *BIS Working Papers*, **443**.

Demirgüç-Kunt, Asli, Laeven, Luc, & Levine, Ross. 2004. Regulations, Market Structure, Institutions, and the Cost of Financial Intermediation. *Journal of Money, Credit & Banking (Ohio State University Press)*, **36**(3), 593–622.

Dewatripont, Mathias, & Tirole, Jean. 2010. *The Prudential Regulation of Banks*. MIT Press.

Dewatripont, Mathias, & Tirole, Jean. 2012. Macroeconomic Shocks and Banking Regulation. *Journal of Money, Credit & Banking (Wiley-Blackwell)*, **44**, 237–254.

Dewatripont, Mathias, Rochet, Jean-Charles, & Tirole, Jean. 2010. *Balancing the Banks: Global Lessons from the Financial Crisis*. New Jersey: Princeton University Press.

Distinguin, Isabelle, Roulet, Caroline, & Tarazi, Amine. 2013 (July). *Bank Regulatory Capital and Liquidity: Evidence from U.S. and European Publicly Traded Banks*. Tech. rept. Rochester, NY.

Djankov, Simeon, & Shleifer, Andrei. 2007. Private Credit in 129 Countries. *Journal of Financial Economics*, **84**(January), 299–329.

Djankov, Simeon, La Porta, Rafael, Lopez-de Silanes, Florencio, & Shleifer, Andrei. 2008. The law and economics of self-dealing. *Journal of Financial Economics*, **88**(3), 430–465.

EBA. 2013. *Review of the consistency of risk-weighted assets*. Tech. rept. February.

Estrella, Arturo. 2004. The Cyclical Behavior of Optimal Bank Capital. *Journal of Banking & Finance*, **28**(6), 1469–1498.

Faccio, Mara, & Lang, Larry H P. 2002. The ultimate ownership of Western European corporations. *Journal of Financial Economics*, **65**(3), 365–395.

Faccio, Mara, Marchica, Maria-Teresa, & Mura, Roberto. 2011. Large Shareholder Diversification and Corporate Risk-Taking. *Review of Financial Studies*, **24**(11), 3601–3641.

Flannery, Mark J., & Rangan, Kasturi P. 2006. Partial Adjustment Toward Target Capital Structures. *Journal of Financial Economics*, **79**(3), 469–506.

Francis, William B., & Osborne, Matthew. 2012. Capital requirements and bank behavior in the UK: Are there lessons for international capital standards? *Journal of Banking & Finance*, **36**(3), 803–816.

Freixas, Xavier, & Rochet, Jean-charles. 2008. *Microeconomics of Banking, second edition*. 2rev ed edn. MIT Press.

Goyeau, D, & Tarazi, Amine. 1992 (July). *An Empirical Investigation on Bank Risk in Europe*. Tech. rept.

Gropp, Reint, & Heider, Florian. 2009 (Sept.). *The Determinants of Bank Capital Structure*.

Hassan, M Kabir, Karels, Gordon V, & Wilcox, Stephen E. 2005. Impact of Ownership Structure and Regulation on the Risk-Taking Behaviour of Depository Institutions. *Journal of Financial Management & Analysis*, **18**(2), 34–40.

Iannotta, Giuliano, Nocera, Giacomo, & Sironi, Andrea. 2007. Ownership structure, risk and performance in the European banking industry. *Journal of Banking & Finance*, **31**(7), 2127–2149.

John, Kose, Saunders, Anthony, & Senbet, Lemma W. 1996 (Jan.). *A Theory of Bank Regulation and Management Compensation*. Tech. rept.

John, Kose, Litov, Lubomir, & Yeung, Bernard. 2008. Corporate Governance and Risk-Taking. *Journal of Finance*, **63**(4), 1679–1728.

Jokipii, Terhi, & Milne, Alistair. 2008. The cyclical behaviour of European bank capital buffers. *Journal of Banking & Finance*, **32**(8), 1440–1451.

Kaufmann, Daniel, Kraay, Aart, & Mastruzzi, Massimo. 2010. The Worldwide Governance Indicators: Methodology and Analytical Issues. *SSRN eLibrary*, Dec.

Kim, Daesik, & Santomero, Anthony M. 1988. Risk in Banking and Capital Regulation. *Journal of Finance*, **43**(5), 1219–1233.

Kishan, Ruby P, & Opiela, Timothy P. 2000. Bank Size, Bank Capital, and the Bank Lending Channel. *Journal of Money, Credit and Banking*, **32**(1), 121–41.

Koehn, Michael, & Santomero, Anthony M. 1980. Regulation of Bank Capital and Portfolio Risk. *Journal of Finance*, **35**(5), 1235–1244.

Köhler, Matthias. 2012. Ownership structure, regulation and the market for corporate control in the EU banking sector. *European Journal of Law and Economics*, **34**(1), 173–196.

Kok, Christoffer, & Schepens, Glenn. 2013. Bank reactions after capital shortfalls. *ECB Working Paper Series*.

La Porta, Rafael, Lopez-de Silanes, Florencio, Shleifer, Andrei, & Vishny, Robert W. 1998. Law and finance. *Journal of Political Economy*, **106**(6).

La Porta, Rafael, Lopez-de Silanes, Florencio, & Shleifer, Andrei. 1999. Corporate Ownership Around the World. *Journal of Finance*, **54**(2), 471–517.

La Porta, Rafael, Lopez-De-Silanes, Florencio, & Shleifer, Andrei. 2002. Government Ownership of Banks. *Journal of Finance*, **57**(1), 265–301.

Laeven, Luc, & Levine, Ross. 2007. Is there a diversification discount in financial conglomerates? *Journal of Financial Economics*, **85**(2), 331–367.

Laeven, Luc, & Levine, Ross. 2009. Bank governance, regulation and risk taking. *Journal of Financial Economics*, **93**(2), 259–275.

Laeven, Luc, & Valencia, Fabián. 2008 (Nov.). *Systemic Banking Crises: A New Database*. Tech. rept.

Laeven, Luc, & Valencia, Fabián. 2010 (Nov.). *Resolution of Banking Crises: The Good, the Bad, and the Ugly*. Tech. rept.

Lindquist, Kjersti-Gro. 2004. Banks' buffer capital: How important is risk? *Journal of International Money and Finance*, **23**(3), 493–513.

Lins, Karl V, Volpin, Paolo F, & Wagner, Hannes F. 2011. Does Family Control Matter? International Evidence from the 2008-2009 Financial Crisis. *SSRN eLibrary*, Nov.

Marshall, David A., & Prescott, Edward S. 2000. Bank capital regulation with and without state-contingent penalties. *Working Paper Series*.

Memmel, Christoph, & Raupach, Peter. 2010. How do banks adjust their capital ratios? *Journal of Financial Intermediation*, **19**(4), 509–528.

Micco, Alejandro, Panizza, Ugo, & Yañez, Monica. 2007. Bank ownership and performance. Does politics matter? *Journal of Banking & Finance*, **31**(1), 219–241.

Miles, David, Yang, Jing, & Marcheggiano, Gilberto. 2013. Optimal Bank Capital. *The Economic Journal*, **123**(567), 1–37.

Modigliani, Franco, & Miller, Merton H. 1958. The Cost of Capital, Corporation Finance and the Theory of Investment. *The American Economic Review*, **48**(3), 261–297.

Myers, Stewart C. 1984. Capital Structure Puzzle. *NBER Working Papers*, **1393**.

Prescott, Edward S. 2001. Regulating bank capital structure to control risk. *Economic Quarterly*, 35–52.

Roberts, Michael R. 2002 (Jan.). *The Dynamics of Capital Structure: An Empirical Analysis of a Partially Observable System*.

Rocha, Gonçalo L. 2013. The impact of capital regulatory shock on bank ownership. *Working Paper*.

Rocha, Gonçalo L. 2015. How banks adjust to a new target capital ratio. *Working Paper*.

Saunders, Anthony, Strock, Elizabeth, & Travlos, Nickolaos G. 1990. Ownership Structure, Deregulation, and Bank Risk Taking. *Journal of Finance*, **45**(2), 643–654.

Schaeck, Klaus, & Cihák, Martin. 2012. Banking Competition and Capital Ratios. *European Financial Management*, **18**(5), 836–866.

Schranz, Mary S. 1993. Takeovers improve firm performance: Evidence from the banking industry. *Journal of Political Economy*, **101**(2).

Shimizu, Katsutoshi. 2015. Adjusting denominators of capital ratios: Evidence from Japanese banks. *Journal of Financial Stability*, June.

Shleifer, Andrei, & Vishny, Robert W. 1986. Large Shareholders and Corporate Control. *Journal of Political Economy*, **94**(3), 461–488.

Shrieves, Ronald E., & Dahl, Drew. 1992. The relationship between risk and capital in commercial banks. *Journal of Banking & Finance*, **16**(2), 439–457.

Stolz, Stéphanie, & Wedow, Michael. 2011. Banks' regulatory capital buffer and the business cycle: Evidence for Germany. *Journal of Financial Stability*, **7**(2), 98–110.

Suarez, Javier. 1998. Closure Rules, Market Power and Risk-Taking in a Dynamic Model of Bank Behaviour. Dec.

Tanda, Alessandra. 2015. The Effects of Bank Regulation on the Relationship Between Capital and Risk. *Comparative Economic Studies*, **57**(1), 31–54.

Tsai, Hsiangping, Chang, Yuanchen, & Lai, Kuanyu. 2009. Ownership Structure, Supervisory Regulation and the Diversification Effects on Bank Performance. *Journal of Financial Studies*, **17**(4).